Vol. XXIV.—No. 153] [June, 1936

THE

MINERALOGICAL MAGAZINE

AND

Journal of

The Mineralogical Society

(*INSTITUTED FEBRUARY 3, 1876.*)

WITH A SEPARATELY-PAGED APPENDIX OF

MINERALOGICAL ABSTRACTS

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LONDON
HUMPHREY MILFORD, OXFORD UNIVERSITY PRESS,
AMEN HOUSE, WARWICK SQUARE, E.C. 4.

1936

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THE MINERALOGICAL MAGAZINE
AND
JOURNAL OF
THE MINERALOGICAL SOCIETY

o. 153 June, 1936 Vol. XXIV

Biographical notices of mineralogists recently deceased. (*Sixth series.*)[1]

By L. J. Spencer, C.B.E., M.A., Sc.D., F.R.S.
Formerly Keeper of Minerals in the British Museum.

[Read March 26, 1936.]

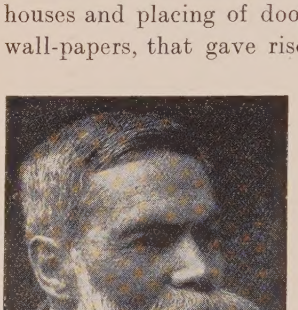
N the following list of 36 lives, with a range in ages from 56 to 89, the average age is 71·0 years. The average of 460 lives noticed this Magazine since 1877 is 65·9 years; and in the six numbers of is series since 1919 there has been a gradual and steady increase om 63·6 to 71·0.

Particulars respecting Czech, Italian, Japanese, and Russian subjects ve been kindly supplied by Professors F. Slavík, G. R. Levi, . Ōhashi, and Mr. S. I. Tomkeieff respectively, and to these colagues I express my thanks.

Barlow (William) [1845–1934], a past-President (1915–18) of this ociety, was born at Islington, north London, on August 8, 1845, d died at his home at Stanmore, Middlesex, on February 28, 1934. e was noted for his pioneer work in the development of the theories crystal-structure and the homogeneous partitioning of space. ter a private education, he entered his father's business, that of a eculative builder, at a time when the northern suburbs of London

[1] Series I–V in Min. Mag., 1921–33, vols. 19–23. An index to earlier notices vols. 1–18 (1877–1919) is given in vol. 19, pp. 259–262, and to later notices in ls. 19–23 (1921–33) in vol. 23, pp. 364–366. A mortality curve is given in vol. p. 253; and a table of averages for different periods in vol. 23, p. 337.

were rapidly developing. On the death of his father he realized t
business, and at an early age was so endowed with a fortune a
leisure for his favourite pursuit. It was, perhaps, the problems
how many houses and persons could be accommodated on an ac
of land and the different ways of arranging them, the partitioning
houses and placing of doors and windows, and the patterns on t
wall-papers, that gave rise to his extraordinary geometrical visio
which had been developed by practic
methods of his own rather than accor
ing to recognized academic methods. H
was an expert wood-worker and cabine
maker, and his workshop, where he co
structed his own models, presented t
appearance of a toy factory with tho
sands of balls of various sizes and colou
and myriads of doll's hands, right a
left, with which to demonstrate the
antiomorphous relations of crystals (
Min. Mag., vol. 11, pls. 1 and 2). Abo
1888 he attended the classes in cryst
lography held by Sir H. A. Miers, a
later by Sir W. J. Pope, at the Cent
Technical College of the London City a
Guilds; and he also spent some ti
in München with the celebrated P. Groth. But he was not mu
influenced by outside teaching, always working out methods of
own. His first paper, in 1883, on the ' Probable nature of the inter
symmetry of crystals ' (Nature, vol. 29, pp. 186, 205) was follow
by a few other short notes on the grouping of atoms in crystals ;
during this period he wrote a book, ' New theories of matter and
force ' (London, 1885, 395 pp.). In 1894 appeared his paper (Z
Kryst. Min., vol. 23, pp. 1–63) in which he independently establis
the 230 space-groups, now of prime importance in the X-ray work
the structure of crystals. This result had, however, already b
arrived at, unknown to Barlow and by different methods, by E
Fedorov in 1890 (but published only in Russian) and by A. Schoen
in 1891. Later, in collaboration with Sir W. J. Pope, a theory of
valency-volumes of atoms in crystals was elaborated. He joined
Geological Society of London in 1887, reading a paper ' On the h
zontal movement of rocks . . .' in 1888, the Mineralogical Societ



W. Barlow.

894, and the Chemical Society in 1897, and he was elected a Fellow the Royal Society in 1908. On the council of our Society he rved for four periods from 1896, and was President in 1915–18. e was a man of simple tastes and engrossed in his work. (W. J. ppe, Nature, London, 1934, vol. 133, pp. 637–638; Journ. Chem. c. London, 1935, pp. 1328–1330; Obituary Notices of Fellows of e Royal Society, 1935, vol. 1, pp. 367–370, with portrait. G. F. H. nith, Quart. Journ. Geol. Soc. London, 1935, vol. 91, pp. lxxxv–xxvi.)

Bell (Robert) [1864–1934], a mineral and fossil collector in the rth of Ireland; was born at Ballycreen, Co. Down, on December 29, 64, and died at Belfast on April 12, 1934, He collected a fine ite of zeolites from Co. Antrim, dopplerite from Sluggan bog ntrim), rare contact-minerals at Scawt Hill (Antrim), and large ocks of orbicular granite at Mullaghderg (Donegal). Many of these e preserved in the mineral collection of the British Museum, thanks the generosity of Mr. F. N. Ashcroft. Acknowledgements to Bell e recorded in this Magazine (**17**–275, **22**–86). He was a life-mber of the Society since 1912. (Irish Naturalist, 1935, vol. 5, 62–63, with portrait.)

Butler (Francis Henry) [1849–1935], mineral dealer and scholar, s born at no. 6 Cheyne Walk, Chelsea, ndon (on the site of the old Manor use where Sir Hans Sloane had his lections), on March 2, 1849, the fifth son Thomas Butler (1809–1907), assistant retary of the British Museum. Two his brothers were also on the staff of British Museum, E. D. Butler in the p room, and A. G. Butler assistant per in charge of the collections of in-ts; and his seven other brothers and ers were medical missionaries. He d at his home at Sutton in Surrey on gust 19, 1935. He studied at the yal School of Mines, London, 1866–taking the associateship in geology. er lecturing on science at Reading, he riculated at Worcester College, Oxford, in 1871, where he was an

F. H. Butler.

exhibitioner, and in 1874 he was placed in the first class in th natural science honour school. In 1877 he entered St. Mary Hospital, London, as a student, and became a fully qualified medic man. Later he was for a time an assistant editor for the nint edition (1875–89) of the Encyclopaedia Britannica. When collectir minerals in Cornwall he became acquainted with Richard Tallir (1820-1883) of Lostwithiel. As Talling's executor he commence disposing of the large stock of minerals in a retail fashion, and at th end of his long career as a mineral dealer in London much of th material still remained on hand. He was elected a member of th Society in 1885, and he contributed seven papers on Cornish minera to this Magazine. He was also the author of a book of verse, 'Qu scripsi' (London, 1902), and of various essays and reviews.

Cook (Charles Wilford) [1882–1933], Professor of Economic Geolo in the University of Michigan, was born at Fenton, Michigan, on Se tember 17, 1882, and died on February 17, 1933. Educated at t University of Michigan at Ann Arbor, he was assistant there first mineralogy and afterwards in economic geology. His early pap in collaboration with E. H. Kraus were on the crystallography datolite and iodyrite, and later he described new occurrences pearceite, ilsemannite, and molybdenite. (W. H. Hobbs, Proc. Ge Soc. Amer., 1934, for 1933, pp. 181–184, with portrait and bibl graphy; W. F. Hunt, Amer. Min., 1934, vol. 19, pp. 114–117, w portrait and bibliography.)

Copaux (Hippolyte) [1872–1934], Professor of General Chemis in the École de Physique et de Chimie in Paris, was born on Marcl 1872, in Paris, and died suddenly on August 28, 1934, at Étamp His main work was chemical, but under the influence of G. Wyroul he published a few papers on the crystallography of polymorph and optically active forms of sodium chlorate, and alkali sil molybdates and cobaltioxalates. He was president of the Fre Mineralogical Society in 1913. (H. Arsandaux, Bull. Soc. Fra Min., 1935, vol. 58, pp. 78–80, with bibliography.)

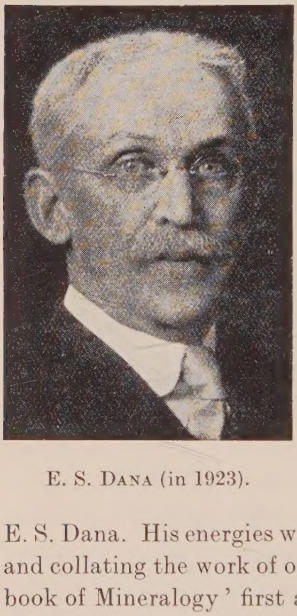
Curie formerly Sklodowska (Marja = Marie) [1867–1934] born in Warsaw, Poland, on November 7, 1867, where her par were school teachers. She died in a sanatorium at Haut-Savoie July 4, 1934. After a school education she worked as a gover in Warsaw, saving sufficient to enter the Sorbonne in Paris a

dent in 1891. There in 1895 she married the physicist Pierre rie (1859–1906; Min. Mag., vol. 14, p. 273), who was unfortu-ely killed in a street accident by a lorry; and she succeeded her sband as the first woman professor in the Sorbonne. Her first work s on the magnetic properties of tempered steel, but with the dis-very of the radioactivity of uranium compounds by H. Becquerel 1896 intensive work was done on this new subject, and in 1898 Curies working together discovered onium (named after her native coun-) and radium. The chemical work s done by Madame Curie, large quanti-s, one to two tons, of pitchblende aninite) from Jáchymov, Bohemia, ng worked up to extract the minute ntities of these new elements. For work the Nobel Prize for physics awarded to H. Becquerel and the ies in 1904, and the Nobel Prize for mistry to Madame Curie alone in 1. Of mineralogical interest is the that no other person has had three minerals named after them—curite, odowskite, and cuprosklodowskite, uranium minerals from the Belgian go. A curie is the name for the unit of radioactivity. Her ghter Irène also married a Parisian physicist, F. Joliot, and they, king together, have recently discovered artificial radioactivity. rd Rutherford, Nature, London, 1934, vol. 134, pp. 90–91; A. F. varik, Amer. Journ. Sci., 1934, ser. 5, vol. 28, pp. 464–466; S. Russell, Madame Curie memorial lecture, Journ. Chem. Soc. ndon, 1935, pp. 654–663, with portrait.)

M. Curie.

Dana (Edward Salisbury) [1849–1935], American mineralogist, born at New Haven, Connecticut, on November 16, 1849, the son . D. Dana (1813–1895) and grandson of Benjamin Silliman (1779–4). He died at New Haven on June 16, 1935, at the age of eighty-. After graduating at Yale in 1870, he worked at mineralogy er G. J. Brush, and in 1872–74 studied at Heidelberg and under Tschermak and V. Lang at Wien (Vienna). Returning to Yale 874, he was appointed curator of the mineral collection in the

Peabody Museum, from which post he retired in 1922. Unfortunate at that time no paid teaching position in mineralogy was vacant, ar he was obliged to take up a tutorship in mathematics, physics, ar chemistry, becoming assistant professor of natural philosophy in 187 and professor of physics in 1890, and retiring from this in 1917, b he still continued to perform various administrative duties in t university. His first paper in 1872 on the labradorite rocks of Wate ville in New Hampshire and another 1874 on the trap rocks of the Connectic valley were the earliest in America microscopic petrography. Several pape on the crystallography of various min als appeared from 1872, some of the in Tschermak's 'Mineralogische Mitth lungen'; and in 1874 a paper with Schrauf on the thermoelectric propert of minerals was published by the Ac emy of Sciences of Wien. In 1879– and again in 1890 a series of papers w G. J. Brush dealt with the remarka phosphate minerals, several of them n species, discovered at Branchville in C necticut. Beryllonite was another int esting phosphate mineral discovered E. S. Dana. His energies were, however, directed more to the record and collating the work of other mineralogists. His well-known 'Te book of Mineralogy' first appeared in 1877 and passed through m editions and reprints, the last by W. E. Ford in 1932. A popu book, 'Minerals and how to study them', appeared in 1895, and elementary text-book on mechanics in 1881. He was responsible the second (1875) and third (1882) appendices to the fifth edition J. D. Dana's 'System of Mineralogy'. But his crowning work the production in 1892 of the sixth edition of this book which been started by his father in 1837. This work, undertaken sin handed, occupied ten strenuous years and unfortunately ended w a nervous break-down. It was entirely rewritten and the crysta graphic constants of each species were calculated afresh, while selection of material showed a wise and balanced judgement. Altho forty-four years have now passed, this volume still remains the stand work of reference, or bible, of mineralogists in every country of



E. S. Dana (in 1923).

vorld. A new (seventh) edition has been in preparation for some years, nd is anxiously awaited, but it will not be a 'Dana'. The American ournal of Science, founded by Benjamin Silliman in 1818, was carried n by the Danas, father and son, and remained the property of the illiman–Dana family until handed over to Yale University in 1926. . S. Dana worked on this since 1875—a period of sixty years. He as an honorary member of this Society since 1897. He had white air, blue eyes, and a ruddy complexion. (C. Schuchert, Amer. Journ. ci., 1935, ser. 5, vol. 30, pp. 161–176, with portrait; W. E. Ford, cience, New York, 1935, n. ser., vol. 82, pp. 343–344; W. E. Ford, mer. Min., 1936, vol. 20, pp. 173–174, with portrait.)

David (*Sir* Tannatt William Edgeworth) [1858–1934], Australian eologist, was born on January 28, 1858, at St. Fagans near Cardiff South Wales, and died at Sydney, New South Wales, on August 28, 934. After a classical education at Oxford, he studied geology at the oyal School of Mines in London, and in 1882 joined the Geological urvey of New South Wales. In 1891 he was appointed Professor of eology in the University of Sydney, retiring in 1924, when he de- oted himself to writing a geology of Australia, but only the map ith explanation was issued at the time of his death. He reported tin-ores, coal, and other mineral deposits, and described diamond, merald, and glendonite from New South Wales, and darwin glass om Tasmania. Of his extensive geological work mention may be ade of his study of glacial deposits in South Wales (in 1882) and ustralia, and in the Antarctic when on the Shackleton Expedition of 907–9. He had charge of the Royal Society Coral-boring Expedition Funafuti in 1897. The pseudomorphous mineral glendonite was med by him, and davidite was named after him. ('Eminent living ologists', Geol. Mag. London, 1922, vol. 59, pp. 4–13, with portrait id bibliography; Sir D. Mawson, Obituary Notices of Fellows of e Royal Society, London, 1935, vol. 1, pp. 493–501, with portrait id bibliography; Quart. Journ. Geol. Soc. London, 1935, vol. 91, . xc–xciii; R. E. Priestley, Nature, London, 1934, vol. 134, . 523–524.)

Day (Thomas Cuthbert) [1853–1935] was born at Burton-on-Trent, here he was engaged in the brewing industry, and was afterwards ad maltster and chemist to an Edinburgh firm. Later he founded e firm of Hislop and Day, photo-process engravers, and with his nowledge of chemistry he was able to introduce improvements in

colour reproduction. The geology of the volcanic rocks of the sou of Scotland he worked at enthusiastically as a hobby, describi volcanic vents and giving many rock analyses in a series of pape in the Transactions of the Edinburgh Geological Society. He w elected a Fellow of the Chemical Society of London in 1881, a died in Edinburgh on June 14, 1935. (A. Lauder, Journ. Chem. Sc London, 1935, p. 1340; R. Campbell, Trans. Roy. Soc. Edinburg 1935, vol. 55, pp. 148–149.)

Dunstan (Benjamin) [1864–1933], Government Geologist Queensland, was born at Castlemaine, Victoria, on July 8, 1864, a died at Brisbane on September 2, 1933. After a period (1891–97) lecturer in geology, mineralogy, and mining at the Technical Colle at Sydney, he joined the Geological Survey of Queensland, becomi Government Geologist in 1908. Since his retirement he was engag in consulting work for mining companies. He produced many repo on the geology of the mining districts and papers on the mine resources of the State, including some on the sapphire of Anakie, ru of Chillagoe, and on other gemstones in Queensland. His 'Queensla mineral index and guide' (1913) is a mine of information on mine localities. (Queensland Government Mining Journal, 1933, vol. p. 276, with portrait.)

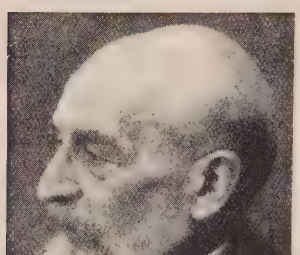
Farrington (Oliver Cummings) [1864–1933], a prominent wor on meteorites, was born at Brewer, Maine, on October 9, 1864, a died at Chicago on November 2, 1933. He had a heart attack 1931 from which he never recovered. After graduating at Ma State College, he was able to save enough by science teaching schools to enter Yale University in 1887, where he studied geol and mineralogy under J. D. Dana and S. L. Penfield, was assist in mineralogy and biology, and took the Ph.D. degree in 1891. a short time in 1893 he was an assistant under his brother-in-l G. P. Merrill (another famous American worker on meteorites) in United States National Museum at Washington, D.C. Early in 18 he was appointed the first Curator of Geology in the new Fi Columbian Museum (now Field Museum of Natural History) Chicago. There for nearly forty years he was prominent for curatorial work; and during part of that time he lectured on mine logy in the University of Chicago and gave assistance in internatio expositions. He also undertook various collecting expeditions,

Mexico in 1896 and Brazil in 1922–23. His earlier and some of his later papers dealt with minerals, but his main work was on meteorites, and he worked with energy in increasing the meteorite collection. As shown in his published catalogues of this collection the number of representative falls was increased from 179 in 1895 to 251 in 1903, and to 657 in 1916; the latter large increase being due to the acquisition of the Ward-Coonley collection. By 1934 the number had been increased to 727 of the 1050 known falls, and said to be the largest number in any collection in the world. In addition to many papers descriptive of new meteorites, useful compilations of the chemical analyses of irons and stony meteorites and a large monograph on the meteorites of North America were published. His book 'Meteorites' (1915) is the only complete work on the subject. In another direction he specialized on the subject of precious stones, writing a book 'Gems and gem minerals' (1903) and museum hand-books on 'Amber', 'Agate', and 'Famous diamonds'. (Ann. Rep. Field Museum of Natural History, Chicago, 1934, vol. 10 (for 1933), pp. 13–14, with portrait; S. K. Roy, Proc. Geol. Soc. Amer., 1934, for 1933, pp. 193–210, with portrait and bibliography.)

O. C. Farrington (in 1930.)

Friedel (Georges) [1865–1933], French crystallographer, was born at Mulhouse in Alsace on July 19, 1865, son of the distinguished chemist and mineralogist Charles Friedel (1832–1899) [Min. Mag. 13–91], and he died at Strasbourg on December 11, 1933. After an education at the Polytechnic School and the School of Mines in Paris, he was an engineer in the Corps des Mines and professor in the School of Mines at Saint-Étienne, becoming in 1907 a Chief Engineer and Director of the school. In 1922 he was promoted to the rank of Inspecteur Général des Mines. Here he did important work on the geology of the coal-fields. In 1919 he was appointed Director of the Geological Institute and Professor of Mineralogy and Crystallography in the reorganized University of Strasbourg. His first research work was with his father in 1890 on the action of alkali solutions at

high temperature and pressure on mica, resulting in the artifici production of nepheline, leucite, sodalit and felspar. In the same year he studie the puzzling mineral melanophlogite. 1896–99 he did important work on tl zeolites, showing that the amount of wat expelled on heating depended on the te sion of aqueous vapour in the surroundir atmosphere, and that the partially d hydrated material was capable of absor ing various gases and liquids into tl spaces vacated by the water. As a pup of E. Mallard he continued the work that master on the reticular structure crystals, especially in relation to theori of twinning, and he was quick to reco nize the importance of the new resul obtained by means of X-rays in 191



G. Friedel.

Other problems to which he made important contributions were t growth and corrosion of crystals; liquid crystals, in which he reco nized a mesomorphous (nematic and smectic) state of matter inte mediate between amorphous and crystalline; and the structure a origin of diamond. He published a 'Cou de minéralogie' (1904) and 'Leçons cristallographie' (1911 and 1926), t last of which gives a good summary some of his original work. (Comp Rend. Acad. Sci. Paris, 1933, vol. 19 pp. 1545–1547; F. Grandjean, Bull. Sc Franç. Min., 1934, vol. 57, pp. 144–18 with portrait and bibliography; R. We Zeits. Krist., 1934, vol. 89, pp. 1– J. D. H. Donnay, Amer. Min., 193 vol. 19, pp. 329–335, with portrait a bibliography.)

N. Fukuchi.

Fukuchi (Nobuyo) [1877–1934] w born at Tokyo on July 15, 1877, a died there on May 22, 1934. After co pleting the geology course at the Imperial University of Toky

e continued as a research student with an investigation on the nodes of occurrence of minerals. For several years he was engaged n the exploitation of mineral deposits with the Furukawa Mining ompany, and was afterwards lecturer in mineralogy in the Imperial niversity of Tokyo, which post he held until the time of his sudden eath. He was an alert little man, always dressed in a kimono, and n excellent performer in old Japanese and Chinese plays and dances, s well as a good painter. He was the author of many papers on the ineralogy and geology of Japan, Korea, Manchuria, and China M.A. 1–134–5], and was one of the active editors of T. Wada's Minerals of Japan'. (T. Ito, Beitr. Min. Japan, 1935, Neue Folge, o. 1, pp. 255–259, with portrait and bibliography.)

Glinka (Sergei Fedorovich), Глинка (Сергей Федорович) [1855–933], Russian mineralogist, was born at Sysert, Urals, on August 26 ld style), 1855. He studied at Kazan and St. Petersburg, and in 881 was curator of the mineral collection and later (1885) docent the University of St. Petersburg. In 1913 he became Professor Mineralogy in the University of Moscow. His first paper in 1885 s on the crystalline form of calcium hydroxide present in hydraulic ment, and he produced two long papers on albite from Russian calities. Text-books were written on mineralogy, crystallography, d building stones. Later papers were published in a journal, Sbornik of the Mineralogical and Geological (later Mineralogical) abinet of Moscow University', which he edited. (Mém. Soc. Russe in., 1933, vol. 62, pp. 276, 298.)

Goldschmidt (Victor) [1853–1933], a distinguished German ystallographer, was born, the son of a Jewish merchant, at Mainz February 10, 1853, and died at Salzburg on May 8, 1933. He ntered, in 1870, the Gewerbeakademie (Technical School) in Berlin ith the idea of becoming an engineer, but in 1871 he passed to the ergakademie (School of Mines) at Freiberg, where in 1874 he quali- d as a metallurgical engineer, and in 1875–78 was assistant to . Richter in assaying and blowpipe analysis. During that period ese were the subjects of his earliest scientific papers. In 1878 he udied organic chemistry under A. von Bayer and palaeontology nder K. A. Zittel at München, and in 1879 petrography under . Rosenbusch at Heidelberg, graduating at Heidelberg in 1880 ith a dissertation on the use of potassium mercuric iodide solution mineralogical and petrographical research, and devising a set of

indicators for the determination of specific gravity. After such a training the sudden and violent devotion to morphological crystallography, which he called the 'Queen of the Sciences', was rather surprising. In 1881 he studied crystallography under A. Brezina at Wien (Vienna), where he remained until 1887, working mostly alone and developing his own system of crystallography. Here he began his well-known and useful 'Index der Krystallformen der Mineralien' (3 vols., 1886–91), a laborious compilation of all the crystal-forms that had been observed on minerals with a critical revision of the whole of the literature. In 1887 he also published 'Krystallographische Projectionsbilder', and 'Projection und graphische Krystallberechnung'. Returning to Heidelberg he became in 1888 a docent in the university, giving no formal lectures, but teaching a few selected research students in his private laboratory. In the same year he married his cousin Leontine von Portheim of Praha (Prag), who, besides bringing ample funds, was a close and helpful collaborator in his work. Later in 1916, they together founded and endowed the 'Josefine und Eduard von Portheim-Stiftung für Wissenschaft und Kunst' in connexion with the University of Heidelberg which includes an Ethnographical Institute, Institute of Folk-lore and the 'Victor Goldschmidt Institut für Kristallforschung'. Victor Goldschmidt was recognized as an extraordinary professor in the university in 1893, and later he was given the title of ordinary honorary professor, but his work was always done in his private laboratory, which attracted serious students from all parts of the world, especially America. In 1893 he devised his first form of two-circle goniometer, and in 1897 published the 'Kristallographische Winkeltabellen', which involved the calculation of some 65,000 angles for crystallized minerals. These are, however, not the natural angles between the crystal faces, but the angles of two-circle goniometry and the gnomonic projection, which depend on one particular and arbitrary setting of the crystal. This 'Goldschmidt method' he enthusiastically and persistently advocated to the exclusion of

V. Goldschmidt (in 1928).

others. A monumental work is his 'Atlas der Krystallformen' 913-23; Min. Abstr., vol. 2, p. 289), with nine quarto volumes of ates reproducing about 30,000 published figures of mineral crystals d nine quarto volumes of text—a most useful work of reference. is numerous published papers, written in a clear and philosophical yle, deal with the crystals of various minerals, their forms, twinning, owth and corrosion, surface characters of the faces ('Accessorien'), .; while others were of a philosophical character with analogies to e regularities in crystals. Some of these were published in his own riodical, 'Beiträge zur Krystallographie und Mineralogie', which started in 1914. A mineral named goldschmidtite in his honour as afterwards proved to be identical with sylvanite, the error ving arisen from a different setting up of the crystal.

Victor Goldschmidt held a unique position in our Society, being ordinary life member since 1886, and also an honorary member ce 1912. He paid many visits to London, where his brother nst Gabriel Goldschmidt (died September 13, 1935, aged 83) was metal merchant. A 'Festschrift Victor Goldschmidt' (Heidelberg, 28) published on the occasion of his seventy-fifth birthday, con- ins an appreciation of his scientific work by L. Milch, his first pil at Heidelberg, with portrait and bibliography of 177 items. fer notices are given by his successor, H. Himmel, in Centr. Min., t. A, 1933, pp. 391–398, with portrait and supplementary biblio- aphy (items 178–188); A. E. H. Tutton, Nature, London, 1933, l. 131, pp. 791–792; and his old pupil, C. Palache, Amer. Min., 1934, l. 19, pp. 106–111, with portrait and supplementary bibliography.

Gränzer (Josef) [1857–1934], Czech mineralogist, was born at chdol (= Zauchtl) in Moravia in August 16, 1857, and died at Opava Troppau) in Czech Silesia on March 17, 1934. He studied at ien (= Vienna), and was assistant there to G. Tschermak. He as afterwards a schoolmaster, and in 1894 professor in the training hool for teachers at Liberec (= Reichenberg) in Bohemia, where er he was also director of secondary schools. He gave a detailed count of epidote crystals from Salzburg, and described a drusy m of orthoclase from basalt; the latter has since been named änzerite after him [Min. Mag. **23**–630]. Some later papers were the rocks and mineral occurrences of northern Bohemia.

Hamberg (Axel) [1863–1933], Swedish mineralogist and later ographer, was born in Stockholm on January 17, 1863, and died

at Djursholm, near Stockholm, on June 28, 1933. After studyin under W. C. Brøgger at the University (Högskola) of Stockholm, h was a docent there in mineralogy and crystallography since 189 In 1907 he was appointed Professor of Geography in the Universit of Upsala, from which post he retired in 1928. He was hydr grapher on A. E. Nordenskiöld's expedition to Greenland in 188 and he also took part in A. G. Nathorst's expeditions to Spitsberge and King Karls Land in 1892 and 1898. His mineralogical wor was published during the period 1886 to 1906, when he described a new minerals caryopilite, flinkite, ganophyllite, manganchlorite, an pyrophanite. The rare beryllium borate, named after him so lon ago as 1890, has since been found as large crystals in Madagasca His later work dealt largely with glacier and sea ice. His collectio of minerals was presented to the Riksmuseum at Stockholm. ((Aminoff, K. Svenska Vetenskapsakad. Årsbok, for 1934, 193 pp. 265–272, with portrait.)

Johnsen (Arrien) [1877–1934], Professor of Mineralogy in t University of Berlin, was born at Munkbrarup in Schleswig d December 8, 1877, and died after an operation on March 22, 193 He studied under G. Linck at Jena, T. Liebisch at Göttingen, a O. Mügge at Königsberg, and from 1904 was assistant to Mügge fir at Königsberg and afterwards at Göttingen. In 1909 he was appointe Professor of Mineralogy at Kiel, where in 1920 he was Rector of t University. In 1921 he succeeded H. E. Boeke at Frankfurt, a in 1922 T. Liebisch at Berlin. His work followed on very much t same lines as that of Mügge, being first petrographical, and later d the structure and deformation (gliding) of crystals. He was Preside of the German Mineralogical Society (1927–30), and for a time edit of the journal of that society. He was instrumental in founding 1928 the German institute for the investigation of precious ston and pearls, and on these subjects he wrote a number of popul articles. (H. Seifert, Forschung und Fortschritte, 1934, vol. 1 p. 175; Zentr. Min., Abt. A, 1935, pp. 3–13, with bibliograph H. Stille, Sitzungsber. Preuss. Akad. Wiss. Berlin, 1934, p. 130.)

Joly (John) [1857–1933], Professor of Geology and Mineralogy the University of Dublin (Trinity College), was born at Hollywoo King's Co., Ireland, on November 1, 1857, his father being of Fren descent, and his mother a German countess of Greek, Italian, a English ancestry. The records of the date (1857 or 1858) of h

rth are contradictory, but John Joly himself 'after examining the atter carefully believed he was born in 1857'. Here are surely e materials for the making of a genius. He died in Dublin on ecember 8, 1933. Entering Trinity College in 1876 he graduated engineering, and from 1882 to 1891 he was demonstrator in civil gineering, and afterwards in experimental physics. He was ap-ointed Professor of Geology and Mineralogy in 1897. The versa-ity and energy of the man overflow-g with bright ideas were astonishing. is published papers cover an extra-dinarily wide range of subjects. Early pers (1884–6) recorded the occurrence beryl, cordierite, and harmotome in unty Wicklow, and described the micro-opical characters of volcanic ash from rakatoa and New Zealand. Ingenious t simple pieces of apparatus were de-sed for determining the specific gravity, elting point (meldometer), volatility pophorometer), specific heat, and the refringence of minerals; the changes volume of minerals and rocks on sion; and the thermal expansion of amond. He also studied the order formation of silicates in igneous rocks, and was the first to examine ving and road stones by petrographical methods. In his specially signed electric furnace crystals of calcium oxide, magnesium oxide, atinum, and palladium were prepared artificially. Later came his portant work in connexion with radioactivity. He was the first give the correct explanation of the pleochroic haloes shown by rtain minerals, and from measurements of these he was able to give estimate of the age of the earth. (He had earlier given an esti-ate of the age of the earth from the amount of salt present in the a.) The radium and thorium contents of different kinds of rocks ere determined, and he elaborated a theory of the development of e earth's internal heat by radioactivity and the consequent changes the crust, a subject on which he wrote many papers, and a book, Radioactivity and geology' (1909). The items mentioned above present but a small part of his many-sided activities. He was ected a Fellow of the Royal Society in 1892, and was President of

J. Joly.

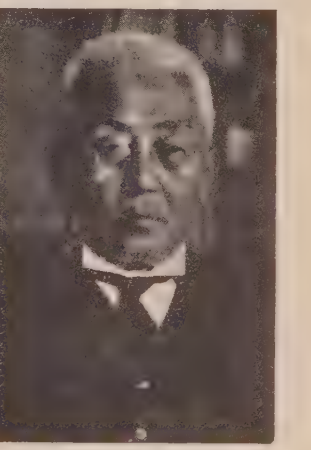
the Royal Dublin Society, in whose Proceedings most of the pape were published. His fine private collection of minerals was b queathed to Trinity College. (Sir Oliver Lodge, Phil. Mag. Londo 1934, ser. 7, vol. 17, pp. 198–200; H. H. Dixon and J. H. J. Pool Nature, London, 1934, vol. 133, pp. 90–92. Obituary Notices Fellows of the Royal Society, London, 1934, vol. 1, pp. 259–28 with portrait and bibliography; L. B. Smyth, Quart. Journ. Geo Soc. London, 1934, vol. 90, pp. lv–lvii.)

Kaiser (Friedrich Wilhelm Erich) [1871–1934], German geologis was born at Essen on December 3 1871, and died at München (Munich) c January 6, 1934, at the age of 62, aft a long illness with heart trouble. Ed cated at the Universities of Marbur München, and Bonn, he graduated physics at Bonn in 1894, where he becan assistant to H. Laspeyres in mineralog From 1900 to 1904 he was a geologist the Prussian Geological Survey, engag mainly with mapping in the Rhineland. 1904 he succeeded R. Brauns as Profess of Mineralogy and Geology in the Un versity of Giessen, and in 1920 w appointed to a new professorship general and applied geology in the Un versity of München. In 1914 he join P. Groth in the editing of the 'Zeitschrift für Krystallographie u Mineralogie', and produced three large index volumes (authors, su jects, and localities) to the set of fifty volumes published since 187 From 1922 he was one of the editors of the 'Neues Jahrbuch f Mineralogie'. His early papers were mainly on the mineralog petrography, and geology of Rheinland. He took every opportuni that offered for travel. In July 1914 he went to South-W Africa to visit an outcrop of nepheline-syenite of which specime had been sent to him (he had already in 1909 and 1912 written diamond and aquamarine from that region) with the result that was marooned there for five years. But he made very good use the opportunity, and produced two large and really remarkal volumes 'Die Diamantwüste Südwest-Afrikas' (1926; M.A. 3–28

E. Kaiser (in 1933).

escriptive of the rocks, desert weathering, and occurrence of diamond the sand-dunes in the Namib Desert. I had the privilege of avelling with him in 1929 in that region, and also in the copper lt of Northern Rhodesia. (R. Brauns, Centr. Min., Abt. A, 1934, . 97–112, with portrait and bibliography.)

Kotô (Bundjirô) [1856–1935], father of Japanese geology and etrology, was born at Tsuwano, pre-cture of Shimané, western Japan, on arch 4, 1856, and died at Tokyo on arch 8, 1935. After taking the course geology at the Imperial University as e first pupil of John Milne in 1875, he nt to Germany and studied at Leipzig der F. Zirkel and at München during 80–3. His first paper dealing with e petrography of some Japanese rocks, rk done in Leipzig, was published by e Geological Society of London in 84, and another paper on piedmon-e-schist appeared in the same journal 1887. Later petrographical papers lt with the crystalline schists of the ichibu district and nepheline-basalt m Manchuria, and he also wrote on the geology of Korea. His ncipal work related to the volcanoes and earthquakes of Japan, d he long had charge of the Volcanological Survey and the Earth-ake Investigation Committee. He was elected a Foreign Corre-ndent of the Geological Society of London in 1905 and a Foreign mber in 1909, and for a short time (1913–17) he was a member of Mineralogical Society. A 'Kotô commemoration volume' kyo, 1925) with his portrait and a collection of scientific papers s issued on the occasion of his seventieth birthday.



B. Kotô.

Kučera (Bruno) [1863–1934], Moravian mineralogist, was born at lké Meziříčí on November 16, 1863, and died at Brno (Brünn) on ober 26, 1934. He was a hospital director at Brno and a keen lector of minerals. His collection, the best that has ever been de of Moravian minerals, is now in the County Museum at Brno. s published list of Moravian minerals was followed by a series of plements (Min. Abstr., **1**–292, **2**–117, **3**–349, **4**–318, **5**–86).

Mackie (William) [1856–1932] was born at Loanends of Durno i Aberdeenshire on April 28, 1856, and died on July 15, 1932, a Glasgow, where he lived after his retirement. After graduating a Aberdeen University he was a science teacher in schools; but return ing to the University he took a medical degree in 1888, and for ov thirty-five years was a medical practitioner in Elgin, and for eightee years also Medical Officer of Health. During his leisure time h worked on the rocks of the north of Scotland, producing a long seri of papers which were published mainly in the Transactions of th Edinburgh Geological Society, of which Society he was President 1925–27. Many chemical analyses were made, and the heav minerals were separated from sedimentary and igneous rocks. In th granites he recorded the presence of dumortierite, allanite, monazit xenotime, &c. (R. Campbell, Trans. Edinburgh Geol. Soc., 193 vol. 13, pp. 106–109, with portrait and bibliography.)

Maclaren (James Malcolm) [1873–1935], mining engineer, was bo on October 23, 1873, at Thames in New Zealand, where his fath was county engineer, and he died on March 13, 1935, at his hon at Gwennap in Cornwall, soon after returning ill from one of h many trips to Australia. I travelled with him part of the way January, 1935, and he then had a distressing cough. He was a pup of James Park at the Thames School of Mines, and after graduatin at the University of Otago he was lecturer in geology and mining the Coromandel School of Mines in New Zealand. Four years we then spent as assistant geologist with the Mines Department Queensland, after which he came to London with an 1851 Exhibitio Research Studentship and worked on the precipitating agents of gol Then for four years (1902–6) he was on the staff of the Geologic Survey of India as mining specialist. Afterwards he started a priva practice as consulting mining engineer and geologist, in which he w eminently successful, reporting for mining companies in all parts the world and travelling extensively. Practically all of his publish works related to occurrences of gold, in New Zealand (1898), Queen land (1900), British Isles (1901), India (1904), &c.; and in 1908 produced an exhaustive treatise 'Gold, its geological occurrence a geographical distribution'. In 1931 he gave an account of the crat lake of Bosumtwi in Ashanti, suggesting that it was a meteori crater. He was elected a Fellow of the Geological Society of Lond in 1901, and a member of the Mineralogical Society in 1925, and

07 took the D.Sc. degree at London University. (Mining Journ. ndon, 1935, vol. 187, p. 195; Mining Mag. London, 1935, vol. 52, . 231–232; L. L. Fermor, Rec. Geol. Survey India, 1935, vol. 69, . 385–386.)

Moss (Richard Jackson) [1847–1934] was appointed Keeper of nerals and analyst to the Royal Dublin Society in 1875, a post eviously held by C. Giesecke and R. H. Scott. In 1878 he also came Registrar, which involved making arrangements for the ıblin Horse Show, art exhibitions, musical recitals, scientific meet-gs, &c. But in spite of this he was able to do some work on Irish nerals. He was the first to describe the peculiar pearly quartz from . Cork, which was independently described by R. Harkness (Min. ıg., **2**–82) under the name 'cotterite'. By grinding pitchblende a vacuum he estimated the amount of helium present. In associa-n with John Joly he founded the Radium Institute of the Royal ıblin Society and devised the radon capillaries. He retired in 21 and died on January 27, 1934. He was a Fellow of the emical Society of London since 1871. (H. H. Poole, Journ. Chem. ., 1934, pp. 563–564; J. H. J. Poole, Nature, London, 1934, vol. 3, p. 440.)

Panebianco (Ruggero) [1848–1930], Italian mineralogist, was born Messina on June 2, 1848, and died at dova (Padua) on March 28, 1930. His ther was English, and his first studies re at the English College in Malta, for two years he studied mathematics Messina University. Joining Gari-di's campaign in 1866, he was taken oner at Bezzecca, but escaped to gland, where he remained until 1870. urning to Italy, he studied at Milano . Roma, graduating at the latter in 8 under the celebrated chemist S. nizzaro, and in 1880 becoming assist-in mineralogy under G. Strüver at ma. In 1882 he was appointed Pro-or of Mineralogy in the University Padova, from which post he retired 923 with the title of Emeritus Professor. His early papers were

R. Panebianco.

on the crystalline form of organic compounds, and many of his late short notes dealt with geometrical and optical crystallography, often criticizing the work of other authors. He founded and edited the 'Rivista di Mineralogia e Cristallografia Italiana', which ran from 1887 to 1918, forming a series of fifty volumes (but these occupy barely a foot on the library shelves). He also commenced in 188 a 'Trattato di Mineralogia', but of this only the first volume dealing with crystallography was published, which was later extended as 'Trattato di Cristallografia morfologica' (Padova, 1905). He appears to have been rather eccentric. Some of his papers were written in Esperanto, and his last, in 1929, in Latin. He objected to naming minerals after kings, and changed the name willemite (after Willem of the Netherlands) to belgite, oblivious of the fact that the mineral did not occur in Belgium.

Prior (George Thurland) [1862–1936], formerly Keeper of Minerals in the British Museum and a past-President of this Society, was born at Oxford on December 16, 1862, and died from heart failure at Hatch End near London on March 8, 1936. His father, George Thomas Prior, kept a small chemist's shop in Oxford, and in the environment the only son developed an inclination towards chemistry, eventually becoming a skilled analyst and a distinguished mineral chemist. He was educated at Christ Church Cathedral School and Magdalen College School, and in 1881 he gained a scholarship (demyship) in natural science at Magdalen College, graduating with first class honours in chemistry (1885) and in physics (1886). For a short time he also studied chemistry under A. Classen at the Technical High School at Aachen in Germany. In 1887 he entered the Mineral Department of the British Museum and, as successor to W. Flight (1841–85), was placed in charge of the chemical laboratory. On the death of T. Davies (1837–92) he also took charge of the extensive collection of rocks; and on the promotion of Sir Lazarus Fletcher to the Directorship of the Natural History Branch of the British Museum (whom he succeeded as Keeper of the department in 1909), he turned over to meteorites. Good curatorial work and original research were done in both of these sections; but, until his retirement under the age limit in 1927, he still remained in charge of the chemical laboratory, personally undertaking all the more difficult analytical work. He was always called upon to make the analyses of new and rare minerals, and many of his results appear in the works of other

hors. With E. Hussak no less than six new minerals were described
m Brazil, namely, derbylite, florencite, lewisite, tripuhyite, senaite,
l zirkelite; with other authors fermorite, iodembolite, and serendi-
e were established as new; while teallite, a rare tin and lead
phide from Bolivia, he described alone. The minerals containing
nium, niobium, tantalum, and rare earths present special difficul-
in their chemical analysis; and one of these, a titano-niobate of
rium and cerium earths from Swazi-
d, analysed by Prior, was named
orite after him by W. C. Brøgger.
his petrographical papers he described
ks from the Antarctic collected by
ss's Expedition in 1839–43 and by
tt's 'Discovery' Expedition in 1901–
also rocks from Abyssinia and East
ica (Kenya and Uganda). Here again
ny of his determinations and short
orts on rocks are to be found in the
ers of other authors.

G. T. Prior (in 1932).

Since 1910 all his published work
ted to meteorites. He described and
lysed in detail the stones (but no
rites) of many new falls. In addi-
n, he made partial analyses of a large
mber of previously known meteorites, and from his results he was
e to show that in meteoric stones 'the richer in nickel is the
kel-iron, the richer in ferrous oxide are the magnesium silicates'.
s may well be called Prior's Law. On it he based a new classifi-
ion of meteorites, depending on the ratios of nickel to iron in the
tallic portion and of ferrous oxide to magnesia in the silicate
tion. He further concluded that by progressive oxidation (the
n, but not the nickel, of the metallic portion being oxidized) all
teoric stones have been derived from the same magma. His
talogue of Meteorites' published by the British Museum (1923,
h appendix 1927) is the standard work of reference, in which all
essential details respecting 992 meteorites then known are col-
ed together.

He joined this Society in 1887, serving on the Council since 1893
art from gaps insisted upon by the bye-laws), and was General
retary for eighteen years (1909–27) and President in 1927–30.

He took the Oxford degree of D.Sc. in 1905, was elected a Fello of the Royal Society in 1912, and was awarded the Wollaston Fun and the Murchison Medal by the Geological Society, of which societ he was a Vice-President in 1921–3. (W. C. Smith, Nature, Londo 1936, vol. 137, p. 485.)

Bibliography of the Works of G. T. Prior.

Most of his more important papers were published in the 'Mineralogic Magazine', the first in 1889 'Note on connellite from a new locality'. These a listed with the full titles in the Indexes to vols. 1–10 (1895) and vols. 11– (1926), and include 35 papers under his own name and 27 with joint autho Other papers are listed below.

63. [with H. A. Miers] Ueber einen antimonhaltigen Proustit. Zeits. Kry Min., 1888, vol. 14, pp. 113–115. [Translation from Min. Mag., 1887, vol. pp. 196–200.]
64. [with H. A. Miers] Beiträge zur Kenntniss des Pyrargyrit und Proust Zeits. Kryst. Min., 1889, vol. 15, pp. 129–193, 2 pls. [Translation fr Min. Mag., 1888, vol. 8, pp. 37–102, 4 pls.]
65. [with L. J. Spencer] Ueber die Identität von Andorit, Sundtit u Webnerit. Zeits. Kryst. Min., 1898, vol. 29, pp. 346–360. [Translation fr Min. Mag., 1897, vol. 11, pp. 286–301.]
66. Petrographical notes on rock-specimens collected by Mr. R. T. Günth in the neighbourhood of Lake Urmi, Persia. Geogr. Journ., London, 18 vol. 14, pp. 521–523.
67. [Report on some fine brown dust collected during a thunderstorm in t Mediterranean.] Nature, London, 1899, vol. 60, p. 205.
68. [Petrographical notes] in M. Fergusson, Geological notes from Tanganyi northwards. Geol. Mag., London, 1901, dec. 4, vol. 8, pp. 362–370.
69. Preliminary report on the rock-specimens collected by the *Southern Cr* Antarctic Expedition. In C. E. Borchgrevinck, First on the Antarc Continent. London, 1901, pp. 324–325.
70. Report on the rock-specimens collected by the 'Southern Cross' Antarc Expedition. In Report on the collections of natural history .... Lond (British Museum), 1902, pp. 321–332, 1 pl.
71. Report on specimens of mud, etc., from the bottom of Lake Nya obtained by Lieut. E. L. Rhoades during sounding operations in 1900 a 1901. Geogr. Journ., London, 1902, vol. 20, p. 69.
72. [with L. Fletcher] Notes on the collections of rocks and mineral specim from the Uganda Protectorate made by Sir Harry Johnston. In Sir Ha Johnston, The Uganda Protectorate. London, 1902, vol. 1, pp. 304–308
73. Notes on rock-specimens from Unyoro. In Sir Harry Johnston, T Uganda Protectorate. London, 1902, vol. 1, pp. 309–310.
74. [with L. J. Spencer] Krystallisirter Zinnkies von Bolivia. Zeits. Kry Min., 1902, vol. 35, pp. 468–479, 1 pl. [Translation from Min. Mag., 19 vol. 13, pp. 54–65, 1 pl.]
75. [with G. F. H. Smith] Ueber das bemerkenswerthe Problem der Entwickelu der Krystallformen des Calaverit. Zeits. Kryst. Min., 1903, vol. pp. 209–234, 1 pl. [Translation from Min. Mag., 1902, vol. 13, pp. 122–15

76. Visit to the British Museum (Natural History). [Demonstration on meteorites.] Proc. Geol. Assoc., London, 1903, vol. 18, p. 145.
77. Note on a pillow-lava apparently forming a continuous horizon from Mullion Island to Gorran Haven in Cornwall. Geol. Mag., London, 1904, dec. 5, vol. 1, pp. 447–449.
78. A new thallium mineral. Nature, London, 1905, vol. 71, p. 534.
79. Report on the rock-specimens collected by the "Discovery." Antarctic Expedition 1901–4. In National Antarctic Expedition 1901–1904, Natural History, vol. 1, Geology. London (British Museum), 1907, pp. 101–140, 3 pls.
80. [with G. F. H. Smith] Über Paratacamit, ein neues Kupferoxychlorid. Zeits. Kryst. Min., 1907, vol. 43, pp. 28–35. [Translation from Min. Mag., 1906, vol. 14, pp. 170–177.]
81. Report on a white siliceous nodule [from the Isle of Wight chalk]. Proc. Geol. Assoc., London, 1908, vol. 20, pp. 289–290.
82. Petrographical notes on the dolerites and rhyolites of Natal and Zululand. Ann. Natal Museum, 1910, vol. 2, pp. 141–157, 4 pls.
83. Pyrochlor; Äschynit; Euxenit-Polykras; Blomstrandin und Priorit; Derbylit (Lewisit, Mauzeliit). In C. Doelter, Handbuch der Mineralchemie, 1913, vol. 3, part 1, pp. 95–108.
84. Polymignit; Niobate und Tantalate. In C. Doelter, Handbuch der Mineralchemie, 1913, vol. 3, part 1, pp. 171, 249–264.
85. Review of progress of mineralogy from 1864 to 1918. Geol. Mag., London, 1919, dec. 6, vol. 6, pp. 10–16.
86. Forms of silica in the Mineral Department, Natural History Museum. Proc. Geol. Assoc., London, 1920, vol. 31, pp. 30–31.
87. Obituary. Sir Lazarus Fletcher, Kt., M.A., F.R.S., etc. Geol. Mag., London, 1921, vol. 58, pp. 141–143.
88. Guide to the Mineral Gallery, British Museum (Natural History). 13th edition, 1921, 32 pp.
89. Catalogue of meteorites, with special reference to those represented in the collection of the British Museum (Natural History). London, 1923, x+196 pp.
90. A guide to the collection of meteorites, with an alphabetical list of those represented. British Museum (Natural History), London, 1926, 43 pp.
91. Three South African meteorites: Vaalbult, Witklip, and Queens Mercy. Min. Mag., 1926, vol. 21, pp. 188–193, 1 pl.
92. Appendix to the Catalogue of meteorites .... British Museum (Natural History). London, 1927, 48 pp.
93. Tektites. Nat. Hist. Mag. (Brit. Mus.), 1927, vol. 1, pp. 8–13.
94. Note on the alkali-lavas of Mount Nimrud, Armenia. Min. Mag., 1928, vol. 21, pp. 485–488.
95. The meteoric stone of Lake Brown, Western Australia. Min. Mag., 1929, vol. 22, pp. 155–158.

RANSOME (Frederick Leslie) [1868–1935], American geologist, was born at Greenwich, London, on December 2, 1868, and died at Pasadena, California, on October 6, 1935. He received his geological training under A. C. Lawson at the University of California at Berkeley,

where he described in 1895 the remarkable new mineral which h named lawsonite. In 1896–97 he was assistant in mineralogy an petrology at Harvard University, working there with C. Palach From 1897 till 1924 he was on the staff of the United States Geologic Survey when he produced a series of valuable monographs on th geology and ore-deposits of the mining districts in Arizona, Colorad Nevada, and Idaho. Later he was professor of economic geology the University of Arizona at Tucson, and since 1927 in the Californ Institute of Technology at Pasadena. Goldfieldite was another ne mineral described by him, and ransomite was named after him. H was an associate editor of the 'American Journal of Science' and 'Economic Geology', and he wrote many articles for encyclopaedi and dictionaries. (W. Lindgren, Econ. Geol., 1935, vol. 30, pp. 841–842

Scharizer (Rudolf) [1859–1935], Emeritus Professor of Mineralog and Petrography in the University of Graz in Steiermark (Styria), w born on April 1, 1859, at Freistadt in Upper Austria, where he return to the family estate after his retirement in 1930, and he died the on December 14, 1935. He graduated in 1883 at Wien (Vienna) a was afterwards assistant there to A. Schrauf. In 1891 he succeed F. Becke as Professor of Mineralogy in the University of Czernowi (now Cernauți in Romania), and in 1909 he succeeded C. Doelter the University of Graz. He was Rector of these two Universities 1902 and 1917 respectively. Since 1879 he had written on Austri minerals, more especially the pegmatite minerals of Bohemia; b his main work was on the constitution and genesis of the iron sulphat on which over a long period (1898–1930) he published a series fourteen papers. He described in 1884 rocks from Jan Mayen, a his analysis of the basaltic hornblende from there showed it to co sist mainly of orthosilicate, to which he applied Breithaupt's (18 name, syntagmatite. In collaboration with his successor, F. Ang he published in 1932 a useful volume on the paragenesis of minera (F. Angel, Zentr. Min., Abt. A, 1936, pp. 88–92, with bibliograph

Schetelig (Jakob Grubbe Cock) [1875–1935], Norwegian mine logist, was born at Asker on December 18, 1875, and died at O after a long illness on October 17, 1935. He started his scient career as an assistant (1900–2) to F. Nansen in working out t oceanographical results of the first 'Fram' expedition (1893– Later, for a short period (1902–3), he was assistant in the Physi

nstitute of the University of Oslo, and in 1905 under the inspiring nfluence of W. C. Brøgger he was transferred to the Mineralogical nstitute. Here he succeeded Brøgger in 1917 as Professor of Mineralogy and Geology and as Director of the Mineralogical and eological Museum. Working with Brøgger, many geological maps ere prepared for the Geological Survey of Norway. His first ineralogical paper was descriptive of new mineral thortveitite, remarkable being a silicate of scandium. Other apers dealt with the rare minerals from egmatites in Arctic Norway and the uth of Norway. He described the rocks llected on R. Amundsen's South Pole xpedition (1911–12), and also a meteor- e which fell in Norway in 1928. He ined the Norwegian Geological Society 1905 and was three times its president, nd since 1923 editor of its journal. . Holtedahl, Nature, London, 1936, ol. 137, p. 58.) Norsk Geol. Tidsskr., 936, vol. 16, pp. 45–51, with portrait nd bibliography.

J. Schetelig (in 1934).

Sederholm (Jakob Johannes) [1863–1934], Finnish geologist and etrologist, was born of Swedish stock at Helsinki (Helsingfors) on uly 20, 1863, and died there on June 26, 1934. Entering the Univer- y of Helsinki in 1882, he began the study of philosophy, but owing delicate health, and acting on medical advice, he turned to geo- gy, which he studied under F. J. Wiik, and afterwards under . C. Brøgger at Stockholm and H. Rosenbusch at Heidelberg. In 888 he was appointed geologist on the Geological Commission urvey) of Finland, becoming director in 1893, and retiring in 1933. xtensive mapping and search for ores of economic value were under- ken, but Sederholm's chief interest was the study of the Archaean ystalline rocks which occupy practically the whole of Finland. He rly showed that the uralite-porphyrites were metamorphosed asalts, and that some other rocks resulted by the assimilation and elting down of pre-existing rocks. In this connexion he introduced e terms anatexis, migmatite, and synantetic. He also studied these ystalline rocks in other countries, making several visits to America,

which he combined with lecture tours. A later paper gave a good collected account of the remarkable orbicular granites of Finland (V. Hackman, Bull. Comm. Géol. Finlande, 1935, no. 112, 29 pp. with portrait and bibliography; Terra, Geogr. Sällsk. Finland Tidskrift, 1934, vol. 46, pp. 129–133, with portrait. E. Antevs, Proc. Geol. Soc. Amer., 1935, for 1934, pp. 259–270, with portrait and bibliography. K. H. Scheumann, Min. Petr. Mitt. (Tschermak), 1934, vol. 46, pp. 89–90.)

Szádeczky (Gyula = Julius) [1860–1935], whose full title was Baron Szádeczky-Kardoss of Szádecsne and Kardosfalva, was Professor of Mineralogy in the University of Kolozsvár (= Klausenburg in Hungary, afterwards known as Cluj in Romania, and also director of the mineralogical collection in the Transylvanian Museum (Erdélyi Múzeum). Later he also served as a geologist on the reorganized Geological Survey of Romania. His work was mainly geological and petrographical, his first paper in 1886 being on Hungarian occurrences of obsidian. He also described rocks and minerals from Egypt. He died on November 7, 1935. (Erdélyi Múzeum, 1935, vol. 40, p. 381. S. von Szentpétery, Acta Chem. Min. Physica, Szeged, 1936, vol. 5, pp. 1–10, with portrait.)

Thomas (Herbert Henry) [1876–1935], Petrographer to the Geological Survey of Great Britain, was born at Exeter on March 13, 1876, and collapsed when alighting from a train at a London railway station on May 12, 1935. He graduated at both Cambridge and Oxford, and from 1898 to 1901 was assistant to the Professor of Geology at Oxford. In 1901 he joined the Geological Survey and was at first engaged in mapping in South Wales, and later, in 1911, was appointed petrographer. In this capacity, rocks collected by the surveyors in all parts of the country passed through his hands for examination and description in the Survey Memoirs. Some of his earlier papers dealt with the minerals present in sands and sedimentary rocks, and he was able to suggest the source of the detrital materials. From his wide knowledge of rocks of all kinds he was able to assign a source to most materials; showing, for example, that the 'blue stones' of Stonehenge must have been transported from Pembrokeshire. In xenoliths in igneous rocks from Mull he found fibrolite (afterwards found to contain an excess of alumina and named mullite), sapphire, spinel, and anorthite. With D. A. MacAlister he wrote a book on 'The geology of ore deposits' (1909). He

ined this Society in 1903 and served for fourteen years on the ouncil, at one period (1921–4) as Vice-President. Six papers, me with joint authors, were contributed to this Magazine. These alt with occurrences of British minerals and with new instruments r determining the refractive index of liquids and for cutting crystal ates and prisms. In the Geological Society of London he served secretary for ten years and was twice Vice-President. He was ected a Fellow of the Royal Society 1927, and in the same year was Presi- nt of the geological section of the itish Association. (Nature, London, 35, vol. 136, p. 95. A. Harker, Obi- ary Notices of Fellows of the Royal ciety, 1935, vol. 1, pp. 591–594, with rtrait.)

H. H. Thomas (in 1927).

Van Horn (Frank Robertson) [1872–33], was born at Johnsonburg, New rsey, on February 7, 1872, and died Cleveland, Ohio, on August 1, 1933. ter graduating at Rutgers College (now iversity) at New Brunswick, New rsey, in 1892, he was assistant in ineralogy under A. H. Chester. Four ars (1893–7) were then spent at Heidelberg studying petrology and ystallography under H. Rosenbusch and V. Goldschmidt, where his ctor dissertation was on the petrography of noritic rocks from Ivrea Piedmont. On his return he was appointed instructor, and in 1899 ofessor, of geology and mineralogy in the Case School of Applied ience at Cleveland, Ohio, where he remained until the end. Here devoted his energy to teaching and organizing the sports clubs, and was also Director of the Cleveland Museum of Natural History. He blished lecture notes on geology (1902) and on mineralogy (1903), d was the author of a number of short papers dealing with unusual currences of American minerals, of which he was a keen collector. was one of the founder members of the Mineralogical Society of nerica in 1919, and for ten years acted as its secretary. (J. E. rde, Proc. Geol. Soc. Amer., for 1933, 1934, pp. 273–288, with rtrait and bibliography. E. H. Kraus, Amer. Min., 1934, vol. 19, . 101–105, with portrait and bibliography.)

Henry Stephens Washington (1867–1934), distinguished as a chemical petrologist, was born at Newark, New Jersey, on January 15, 1867, and died at Washington, D.C. on January 7, 1934. After graduating A.B. in 1886 with special honours in natural science at Yale College (afterwards University), he held the Silliman Fellowship in Physics and was Assistant in Physics until taking the A.M. degree in 1888. He had studied there under J. D. Dana, E. S. Dana, G. J. Brush, H. L. Wells, and S. L. Penfield.

H. S. Washington (in 1920).

In his first paper, with W. F. Hillebrand, in 1888 he described the crystallography of rare copper arsenates from Utah. Four years were then spent in travel in the West Indies, Europe, Egypt, Algeria and Asia Minor, and during the winter semesters of 1891–2 and 1892–3 he studied at the University of Leipzig under F. Zirkel and C. H. Credner, taking the Ph.D. degree with a dissertation on 'The volcanoes of the Kula basin in Lydia' (printed in New York in 1894). He also joined the American School of Classical Studies at Athens, taking part in and conducting excavations at several sites in Greece. The results of work done with his brother Charles M. Washington at Phlius in 1892 were published many years later (1923) in the American Journal of Archaeology. After returning to America he was for a short time (1895–6) Assistant in Mineralogy at Yale. But from 1896 till 1912 he worked in his private laboratory at Locust, New Jersey, analysing and describing the rocks which he had previously collected in Europe and Asia Minor and producing a long series of important papers and books, including his standard text-book 'Manual of the chemical analysis of igneous rocks' (1904; 4th edition, 1930), the tabulated 'Chemical analyses of igneous rocks' (1903; 2nd edition of 1201 quarto pages in 1917) and the celebrated Cross-Iddings-Pirsson-Washington 'Quantitative classification of igneous rocks' (1903). Later he offered his services as a consulting mining geologist (1906–12), but this did not interrupt the flow of petrological papers, during which period appeared his 'Roman co-magmatic region' (1906), and he described the new minerals linosite and (with F. E. Wright) anemousite and carnegieite.

In 1912 he joined the staff of the Geophysical Laboratory of the rnegie Institution of Washington as petrologist. There until the d he continued his work on just the same lines as before, giving tailed chemical analyses and careful petrographical descriptions igneous rocks from various regions. He also analysed many rock-rming minerals (the physical data of which were determined by . E. Merwin) and ancient stone implements. Partly in collabora-n with F. W. Clarke he produced a series of papers on the average mposition of the earth's crust and even of the whole earth.

Dr. Washington had a striking personality, and with his tall stature, ng white hair and beard, and distinctive dress he presented quite picturesque figure. He was hospitable and generous (which I was rtunate in experiencing) and was popular in many circles. A cigar as his constant companion, and he handed one to whoever he met. was playfully suggested that tobacco-ash accounted for the high rcentages of potash in his rock analyses. He was elected a Foreign rrespondent of the Geological Society of London in 1904 and a reign Member in 1921, and was Honorary Member of the Academies Lincei (Roma), Zelanti (Acireale), Torino, Modena, France, Spain, Norway, and a Cavalier of the Order of the Crown of Italy. He as elected a member of this Society in 1923, and his election as an norary Member in 1932 gave him much pleasure during his last ness. (C. N. Fenner, Science, New York, 1934, vol. 79, pp. 47–48. ry G. Keyes, Zeits. Vulkanologie, Berlin, 1934, vol. 16, pp. 1–6, ll. portrait and bibliography. A. Pelloux, Boll. Soc. Geol. Italiana, 35, vol. 53, pp. ciii–cviii, with Italian bibliography. J. V. Lewis, ner. Min., 1935, vol. 20, pp. 179–184, with portrait. S. Kôzu, rn. Japanese Assoc. Min. Petr. Econ. Geol., 1934, vol. 12, pp. 41–, with two portraits. Nature, London, 1934, vol. 133, pp. 557–8. L. J. Spencer, Quart. Journ. Geol. Soc. London, 1934, vol. 90, . xlix–l. T. F. W. Barth, Min. Petr. Mitt. (Tschermak), 1936, l. 47, pp. 371–372.)

ZHEMCHUZHNYI (Sergei Fedorovich), Жемчужный (Сергей Федорович) 373–1929] was born at Kerch in the Crimea on June 24, 1873, and d at Leningrad on September 27, 1929. In the literature there various forms of transliteration of his name, e.g. Žemčužnyj, mczwżnyj, Schemtschuschnij, Shemtschushni, and several other riations. He graduated at Moscow University in 1895 and at the Petersburg Mining Institute in 1900. From 1901 he was lecturer

in inorganic chemistry in the St. Petersburg Polytechnic Institute Several of his papers have a mineralogical bearing, dealing with th salts of salt-lakes (1899; M.A. **2**–129), porphyritic structure an eutectics (with F. Y. Levinson-Lessing), melts of alloys and salt (M.A. **2**–154), structure of native platinum (M.A. **2**–441) and gold liquid crystals, chemical equilibrium, crystallization, &c.

A later death is that of:

Gregory (Albert George Frederick), January 15, 1864–May 5, 1936

Notes on the occurrence of fluorite in Aberdeenshire and Banffshire.

By Arthur Russell.

[Read January 24, 1935.]

FLUORITE is by no means a common mineral in Scotland, and Scottish specimens, with the exception of those from Craigschat quarry, Gourock, Renfrewshire, are very rarely to be seen collections. In the following notes an account is given of some the more remarkable occurrences visited by the writer in the mmer of 1934. Others recorded by M. F. Heddle[1] were also visited are mentioned, although they no longer yield specimens.

Abergairn lead mine, Glen Gairn, Ballater, Aberdeenshire. (One-inch inance Survey of Scotland, popular edition, sheet 44; six-inch erdeenshire sheet 91 NE).

This small but interesting mine (Corrybeg mine of Heddle) is ated about one mile north-west of Ballater. The occurrence of ena here was known prior to 1794, but according to the old atistical account of Scotland', 1794, vol. 12, p. 227, no attempt been made to find the vein. It is referred to by William cGillivray in his 'Natural history of Deeside and Braemar', 55, p. 199, as an abandoned mine from the dump of which he lected cubes of yellow fluorite. The mine was apparently opened ween 1820 and 1830, but attained a depth of only six fathoms, shafts being sunk, a number of pits made on the vein, and a llow level driven in from the hillside.

The main vein, a fault fissure, has a direction about north-north-t, and has been traced for about 120 yards. It is, according to ddle, intersected by another vein, both of them containing fluorite. enclosing rock is hornblende-schist and fine-grained siliceous ist very near the granite.

The specimens described in the following notes were obtained by writer in digging through the old dump and by breaking up e masses of vein-stuff which had been built into a wall. Typical

[1] M. F. Heddle, The mineralogy of Scotland, 1901, vol. 1, p. 40.

specimens of the vein-filling show the following sequence of mineral from wall to wall: quartz with a very pale greenish steatite-lik mineral and greenish-grey siliceous schist containing small crystal of pyrite; white lamellar calcite (schieferspar); bluish-grey-gree to purplish blue fluorite containing small crystals of galena an yellow blende; a very thin band of deep violet fluorite; ivory coloured crystalline granular orthoclase; and calcite into whic project from the granular material slender prismatic crystals o orthoclase.

The following are the characters of the minerals observed:

Fluorite forms one of the principal vein constituents and whe massive the prevailing colours are bluish-grey-green to greyish blu When crystallized there is a complete and remarkable sequence o forms from the simple cube and simple octahedron to an almos globular habit showing six crystal forms (with a possible total o 122 facets).

The following six types of crystals may be distinguished:

1. Deep honey-yellow cubes up to 4 cm. along the edge, ofte with the corners clear and smooth, central portion of the faces bein cloudy and showing raised cubic corrosion figures. These crysta are often encrusted with small yellowish stained crystals of orth clase of adularia habit, and are associated with small bipyramid crystals of quartz.

2. Small pale yellow cubes up to 4 mm. along the edge with wel developed faces of m (311).

3. Associated with the large, deep honey-yellow cubes are smal up to $1\frac{1}{2}$ mm., beautifully symmetrical and nearly colourless crystal combinations of a (100), d (110), f (310), o (111), m (311), V (15.6.2 These crystals graduate between elongated cubes with small faces all the forms given above, to nearly globular crystals in which th same forms are all more or less largely developed. Fig. 1 represen one of the crystals measured. The mean of four measurements the angle (15.6.2) : (100) is 22° 59′, calculated 22° 51¾′. Some of th elongated cubes have curious raised edges suppressing (110) an (310), with an opening at each corner (this peculiarity was notice by Heddle).

4. Small pale violet or colourless cubes up to 5 mm. with wel developed faces of d (110); with small octahedral crystals of galen (100), (111), yellow blende, calcite, and quartz.

5. Small very pale violet to almost colourless corroded crysta

00) with largely developed (111) and (110), with deep violet-blue face patches parallel to the cube or octahedron faces. Associated h these are small white crystals of orthoclase of adularia habit.

6. Very rarely small (4 mm.) greyish-blue simple octahedra; with all prismatic crystals of quartz in cavities in massive fluorite of same colour.

Heddle in his 'Mineralogy of Scotland' (pls. XI and XII) has figured ht crystals from this locality, showing the combinations *af*, *afo*, , *adm*, *admo*, *an*, *adno*, *ap*; and he o mentions the combination *ao*.[1] s crystallographic descriptions and wings are, however, often very eliable.

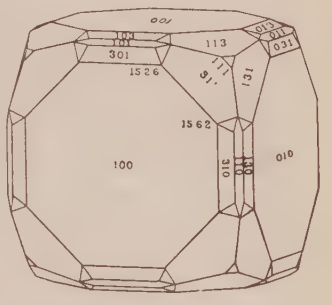


FIG. 1. Crystal of fluorite from Abergairn mine, Ballater, Aberdeenshire.

The bluish-grey-green to greyish- e fluorite from this locality ex- its brilliant phosphorescence on ting, showing first green, then -blue, and finally violet. The ber-yellow is non-phosphorescent. e are fluorescent under the ultra- let rays.

Blende. This is one of the few loca- s in the British Isles that yield light yellow blende. It occurs leavage masses and rough crystals, in colour yellowish-brown, ny to honey-yellow, embedded in greyish-blue fluorite, calcite, ivory-coloured crystalline orthoclase, forming an attractive com- tion of colours. The crystals, which attain a diameter of 1½ cm., combinations of *o* (111), *d* (110), *n* (211), many of them twinned on). The combination *d* (110), *m* (311) also occurs according to dle. This blende is phosphorescent when heated, but shows no rescence.

alena as small cubes along with blende is sparingly distributed ugh the fluorite. Small dull grey cubes and octahedra with) often superficially altered to cerussite occur in cavities.

erussite, rarely as small white prismatic and tabular crystals, 10), *m* (110), *p* (111), in cavities with galena and fluorite.

yromorphite and *erythrite* were observed as minute traces.

yrite, small embedded crystals, *e* (210), occur sparingly in the tzose portion of the vein and in the adjoining schist.

[1] Letters as in Dana, System of Mineralogy, 6th edit., 1892.

Chalcopyrite is occasionally present as small spots associated wi galena and blende in the fluorite.

Manganite. Heddle records very minute crystals, *c* (001), *k* (23 as occurring here with fluorite.

Psilomelane occurred, according to Heddle, very rarely in quar with fluorite, galena, and blende.

Orthoclase. A rib of peculiar ivory-coloured crystalline granu orthoclase up to 2 cm. in thickness lying between fluorite and calc appears to be persistent in the vein. This orthoclase has a spec gravity 2·56 and refractive index 1·523. Projecting from granular material and embedded in the adjoining calcite, or m rarely free when the calcite has been dissolved, are long slend somewhat diverging rhombic prisms, up to 1 cm. in length, *m* (1 terminated by *c* (001), and much elongated in the direction of *c*-axis. These crystals are too rough for measurement, but they undoubtedly orthoclase, although presenting such an unusual slen habit for that mineral.

Orthoclase is also present in the form of small (2 mm.) white yellowish crystals of simple adularia habit, *m* (110), *c* (001), occupy cavities with small purple cubes (*ao*) of fluorite; while associated the large yellow cubes of fluorite, either investing them as a crus lining cavities, are small, deep yellowish-brown stained, short s crystals, *c* (001), *m* (110), *x* ($\bar{1}$01), with a tendency to polysynth development.

It seems probable that the dolomite recorded from here by Hed but of which the writer has seen no trace, was in reality orthocl

Creag an t-Seabhaig, north side of the Pass of Ballater, Ball Aberdeenshire. (One-inch Ordnance Survey of Scotland, pop edition, sheet 44; six-inch Aberdeenshire sheet 91 NE.)

Robert Jameson recorded the occurrence of fluorite at this loc as long ago as 1804. It is also referred to by Greg and Lettson ' Balater House ', and by M. F. Heddle as ' near Monaltrie Hous the Pass of Ballater '.

The specimens which form the subject of the present notes obtained last summer by the writer by breaking up three very blocks, each weighing several hundredweights, which had f evidently some years ago, from a large vein high up on the cli granite face of Creag an t-Seabhaig overlooking the road o

[1] R. P. Greg and W. G. Lettsom, Mineralogy of Great Britain and I 1858, p. 24.

rth side of the Pass of Ballater. The exact position of the vein uld not be determined, but the granite scree forming the lower rt of the escarpment is now being removed, and as a result material m higher up is constantly descending to the road level. The cks in question consisted of crystalline, comby and often some- at smoky quartz, fluorite, and included subangular fragments of ered granite, the constituents of which are quartz, pink orthoclase, d yellowish buff-coloured gilbertite. Included in the fluorite are ely small spots of galena.

The fluorite in mass shows a zonal concentric structure following tahedral outlines, the centre of each structure often showing a tinct deep blue-green-grey octahedron which on fracture of the ss is sometimes partly isolated. This is succeeded by bands of ite, dark slate-violet, and deep bluish-grey-green. More rarely, fluorite is finely banded in heliotrope-grey, green, vinaceous- rple, and white, all the bands having minute spots of deep purple; contrasts of these colours, in both cases, being very beautiful. one very quartzose block the fluorite is opaque white to very htly greenish, with the same zonal structure, and forming a sort breccia with light drab-coloured rounded fragments of crystalline artz.

Cavities in these masses are lined with crystals of fluorite, small ourless prismatic crystals of quartz, and occasionally contain all tabular twinned crystals of cerussite. The fluorite crystals sent the following characters:

1. Violet-grey to, in part, opaque heliotrope-grey cubes up to 2 cm. ng the edge.

2. Dull violet-black cubes, some with small faces of (15.6.2), up 1 cm. along the edge.

3. Very pale violet cubes with small, deep violet triangular rkings at each corner.

4. Small pale green cubes grouped in parallel positions.

5. Small two-coloured violet and green cubes up to 2 mm. along edge, more or less grouped in parallel position, with a tendency assume polysynthetic octahedral aggregates. Some of these stals show an extremely beautiful colour figure. The outer violet e has a smaller green octahedral plan set diagonally within and versed by a cloudy white axial cross (fig. 2).

The multi-coloured and white fluorite from this locality exhibits markably brilliant and persistent phosphorescence on heating:

first green and then a beautiful violet. Its fluorescence is extreme feeble.

In the wood about 1600 yards a little east of north of Creag a t-Seabhaig a trial has been made on a small galena-fluorite-bearin vein traversing the granite, and is probably the actual locali referred to by R. Jameson in 1804. It is shown as 'Old Lead Min on the six-inch Ordnance map, Aberdeenshire sheet 91 NE.

Fig. 2. Fluorite from Ballater, showing zonal structure and white axial cross.

Tomnakiest upper granite quarr Cambus O'May, Ballater, Aberdee shire. (One-inch Ordnance Survey Scotland, popular edition, sheet 4 six-inch Aberdeenshire sheet 81 SW.

Fluorite occurs here rarely as a thi finely crystalline, deep greyish-lave der crust, and as minute, pale yellowi cubes, with yellow gilbertite on join faces of pinkish granite.

Neil's granite quarry, Rinabaich, B later, Aberdeenshire. (One-inch Or nance Survey of Scotland, popul edition, sheet 44; six-inch Aberdee shire sheet 91 NW.)

Here the vertical joint-faces of the fine-grained pinkish granite sometimes thickly encrusted with small (2 mm.) dark purple-dr cubes of fluorite.

The following localities for fluorite are given by M. F. Heddle his 'Mineralogy of Scotland', 1901, vol. 1, p. 42:

Coilacriech, Ballater, Aberdeenshire. (One-inch Ordnance Surv of Scotland, popular edition, sheet 44; six-inch Aberdeensh sheet 91 NW.)

Fluorite is stated by Heddle to occur as violet crystals in a l of yellow metamorphic limestone above this place. He also, on authority of Michie, gives the north bank of the river Dee n Coilacriech as a locality for fluorite. The writer failed to f fluorite at either of these localities.

Crathie limestone quarry, Creag a Chlamhain, Crathie, Aberdeensh (One-inch Ordnance Survey of Scotland, popular edition, sheet six-inch Aberdeenshire sheet 90.)

Fluorite occurred here rarely as violet crystalline patches in w crystalline calcite in metamorphic limestone, associated with gar

llastonite, &c. There is a specimen of this description, collected Heddle, in the Royal Scottish Museum, Edinburgh. The quarry s been abandoned for many years, and the writer failed (1934) to d any fluorite.

Muir limestone quarry, Aboyne, Aberdeenshire. (One-inch Ordnance rvey of Scotland, popular edition, sheet 44; six-inch Aberdeenshire eet 93 NE.)

Fluorite is recorded from here by Heddle as deep purple octahedra sociated with diopside, graphite, sphene, and pyrrhotine in a artzose belt in metamorphic limestone.

Midstrath limestone quarry, Aboyne, Aberdeenshire. (One-inch dnance Survey of Scotland, popular edition, sheet 44; six-inch erdeenshire sheet 94 NW.)

Fluorite is also recorded from here by Heddle under conditions ctly similar to those at Muir. Both Muir and Midstrath quarries e been abandoned for many years; the former is much overgrown the latter full of water, and the writer failed (1934) to find any the recorded minerals.

James Sowerby, in his 'British Mineralogy', 1804, vol. 1, p. 59, and te 26, figures and describes a specimen of fluorite from Aberdeen-re. This shows small dark purple octahedra, some with greenish eriors, on calcite and baryte (cawk), the latter mineral being bably a wrong identification. This specimen may possibly have en from either Muir or Midstrath quarries.

Na tri Chaochain, river Avon between Tomintoul and Inchrory, nffshire. (One-inch Ordnance Survey of Scotland, popular edition, eet 44; six-inch Banffshire sheet 43.)

Attention was probably first called to this remarkable occurrence fluorite by the local keepers, who have been responsible all over Highlands for pointing out many of the more inaccessible locali-s of striking minerals. Professor James Nicol seems to have been first to record the occurrence in William MacGillivray's 'Natural tory of Deeside and Braemar', 1855, for this contains a list of nerals occurring in the Braemar district drawn up by Nicol, and ongst them it is stated that fluorite occurs 'in the granite of Glen n (Avon) above Pomantoul [Tomintoul] and at Alt-tri-chaochan'. ddle also visited the place, and it was briefly referred to by nel W. Hinxman in 'The explanation of sheet 75, Mem. Geol. rvey of Scotland', 1896, p. 14, and in more detail by Heddle in posthumous 'Mineralogy of Scotland', 1901, vol. 1, pp. 41–42.

The following observations are based on repeated visits to the locali by the writer in the summer of 1934, much kindly and intellige help having been rendered by the keepers, Mr. Angus MacDona and Mr. Alexander Stevenson.

The locality is situated on the property of the Duke of Richmo

Fig. 3. Na tri Chaochain, Banffshire. View showing two of the three bu with the river Avon in foreground. That on the right is the one from wh the specimens described were obtained.

and Gordon, 5½ miles south of Tomintoul on the Inchrory road, a about 400 yards from the west bank of the river Avon. Here th small parallel rocky burns (Na tri Chaochain, or Allt tri Caochan Heddle), often nearly dry during the summer months, have narrow gorges in the hill-side before joining the Avon (fig. 3). T hill is composed of light grey mica-schist with thin bands a lenticles of light to dark grey highly metamorphosed limesto About 400 yards from their junction with the Avon all three bu are traversed by a fault having a north-west and south-east directi but it is only in the middle one that the mineral contents of this fa are well exposed, and it is here seen to contain an abundance of fluor

The filling across the fault from west to east consists, as far as n be seen, of a breccia made up of angular fragments of more or ss silicified mica-schist, sometimes containing small garnets, and veloped in comby and radially aggregated quartz, violet and green iorite, pink and white calcite, with no metallic minerals save a ace of pyrite. Only a very few yards of the fault are exposed ong its strike, and its width, which is very considerable, is largely

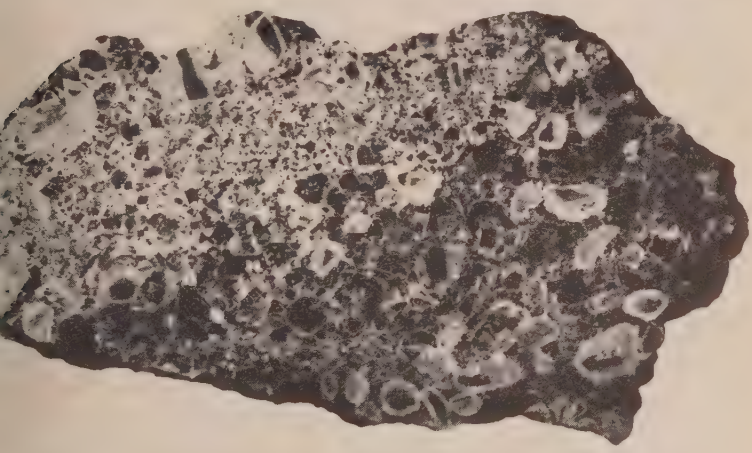


Fig. 4. Fluorite, quartz, mica-schist breccia from Na tri Chaochain, Tomintoul, Banffshire.

asked by the bed of the burn being filled with loose rock. This nsists of slab-like masses of mica-schist, many of them showing their weathered surfaces numerous crystals of altered andalusite eraging 1 cm. in length, light grey slaty limestone, and large asses of the breccia, also occasional water-worn boulders of trans- rted pinkish granite (the nearest granite being distant about three iles to the south). Similar rock material is present in both the her burns, though fluorite is far less abundant. The fluorite occurs follows:

1. Large masses consisting of a breccia of small angular fragments silicified mica-schist surrounded by aureoles of minute, radially ranged white quartz crystals, set in a groundmass of dark violet iorite. In the interior of some of the masses the mica-schist nuclei e hardly, if at all, apparent, and the quartz forms white radial gregates (fig. 4). This particular occurrence of fluorite is unlike y other known in the British Isles.

2. Dark violet-grey to blackish-violet-grey octahedra, up to 4½ cm along the edge. These crystals have somewhat the character of cleavage octahedra from the fact that they do not occur in open cavities, but are included in very easily cleavable crystalline fluorite and are only exposed when such violet masses are carefully broken leaving sharp octahedral casts. Their faces are, however, rough and dull in contradistinction to the cleavage octahedra. In some cases their easy separation is due to the fact that they are enveloped in a very thin layer of calcite, while some of the larger crystals have their faces traversed by numerous narrow bands of white calcite which occupy the octahedral cleavage planes. These crystals were all obtained from the west side of the fault just below the small waterfall high up the burn.

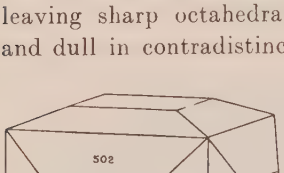


Fig. 5. Crystal of fluorite from Na tri Chaochain, Tomintoul, Banffshire.

3. Very rarely as small (up to 2 mm) slightly pinkish four-faced cubes *a* (100) *k* (520) (fig. 5), resting on minute green drusy quartz crystals, on a quartz and mica-schist breccia. A single specimen of this description was obtained from among the loose material in the bed of the middle burn.

4. Sage-green to celandine-green veins with pink coarsely cleavable calcite; also as large masses, celandine-green and dark to pale violet.

5. Green octahedra, and green octahedra with a thin outer layer of dark violet, up to 2 cm. along the edge, enclosed in a brecciated groundmass of comb-like and radially arranged quartz surrounding mica-schist fragments. This breccia contains many cavities lined with minute quartz crystals covered with pearly white scaly sericite. One cavity in such a mass contains a single minute dark violet polysynthetic four-faced cube of fluorite. These specimens were obtained from loose blocks in the lower part of the burn.

Heddle mentions the occurrence of pale green fluorite in rude cubic crystals, about ten inches along the side, embedded in calcite. If this observation is correct the particular exposure is now obliterated as no trace of such a thing was observed by the writer.

The dark violet-grey fluorite from this locality exhibits a bright blue-violet phosphorescence on heating; the green, first a green and then violet. It shows no fluorescence.

The only other mineral observed was prochlorite (recorded by ddle), which occurs rarely as rosettes, up to 5 mm., formed of -sided platy crystals, internally greyish-green and externally sty-brown, associated with quartz and calcite.

Maisley limestone quarry, Keith, Banffshire. (One-inch Ordnance rvey of Scotland, popular edition, sheet 29; six-inch Banffshire eet 20 NW.)

Fluorite was known from here prior to 1858, and the locality is ntioned by Heddle ('Mineralogy of Scotland', 1901, vol. 1, pp. 42, ; pl. xi, fig. 2) on the authority of Cunningham. It is stated to ve occurred as purple octahedral crystals, *o* (111), *a* (110), *n* (211), sociated with stibnite in grey limestone. In the description under orite there is a misprint of 'stilbite' for stibnite. This quarry s been long abandoned and is now much grown over, and the ter failed (1934) to find a trace of either of these minerals. Two cimens of massive foliated stibnite from here are preserved in the yal Scottish Museum, Edinburgh.

Baryte crystals from the Manvers Main colliery, Wath-upon-Dearne, near Rotherham, Yorkshire.

By Arthur Russell.

[Read March 15, 1934.]

EARLY in the summer of 1930 there was exposed in the Parkga Seam, No. 3 Pit of the Manvers Main colliery, Wath-upo Dearne, near Rotherham, Yorkshire, a large cavity lined wi exceedingly beautiful crystals of baryte; this being the first occu rence of the kind recorded in the south Yorkshire coalfield. T cavity was quickly more or less completely wrecked by the mine when fortunately my friend, Mr. C. P. Finn, the Company's chemi had his attention drawn to the matter, and as a result some br notes on the occurrence, accompanied by a photograph of a specim were published by him.[1] Thanks to the efforts of Mr. Finn, and the result of visits to the colliery, I was able to obtain some very f and interesting specimens of the mineral.

The cavity was in a compact grey sandstone, directly overlying t Parkgate Seam, and apparently occupied a small fault. Its dimensi as ascertained by Mr. Finn were 5 yards in length, 5 yards in heig and from 12 to 15 inches wide at the base, tapering to nothing at t apex, and it was discovered only by the falling away of the sandst roof.

The baryte crystals, which are colourless and more or less tra parent, are of two distinct types, prismatic and tabular, the occurre of the two habits in the same cavity being somewhat remarkal They are attached to small cream-coloured rhombohedra of dolom which form a coating on the sandstone, both baryte and dolon being for the most part more or less thickly sprinkled with small, to 2½ mm., bright twinned crystals of chalcopyrite which enhance beauty of these remarkable specimens. In Mr. Finn's notes th crystals of chalcopyrite were in error called pyrite. The prism

[1] C. P. Finn, An occurrence of barytes in the Parkgate (south Yorksh seam. Trans. Inst. Mining Engineers, 1930, vol. 80, pp. 25–26; and Tr Midland Inst. Mining Engineers, vol. 31.

ystals also sometimes contain minute included crystals of chalco-rite, and on the dolomite there are rarely one or two minute ggregates of bright octahedra of galena, and still more rarely minute ystals of blende.

Crystals of baryte of both habits were measured on the goniometer. he prismatic crystals (fig. 1), which are sometimes doubly terminated, tain a length of 7 cm.; and those of the tabular habit (fig. 2), which

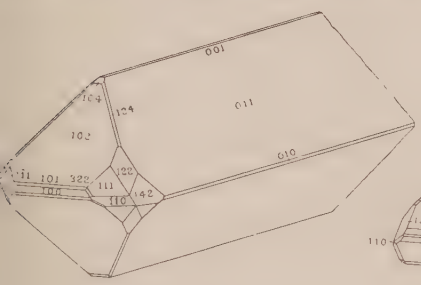


Fig. 1.

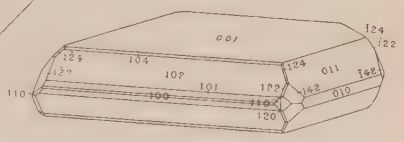


Fig. 2.

Baryte crystals from the Manvers Main Colliery, Yorkshire.

e often nearly square in outline, measure 5 cm. along the edge. The llowing forms [1] were observed :

a (100), b (010), c (001), m (110), n (120),

ψ (1.0.20), l (104), g (103), d (102), u (101), D (302), o (011),

z (111), μ (124), y (122), ξ (142), γ_1 (322).

The forms (120), (1.0.20), (103), and (302) are present only on the ystals of the tabular habit, and, with the exception of (120), they e represented only by very narrow faces. On the drawing of the bular crystal (fig. 2) the very narrow faces of (103) and (302), as so a minute face of (111), are not shown.

ψ (1.0.20), as repeated faces oscillating with (001), lies in the zone u] and gave a measured angle to (001) of 4° 33½′ (calculated 36½′). This was noted as a vicinal face by J. Valentin in 1899 on ryte from Kronthal, Alsace.

γ_1 (322), present only on the crystals of prismatic habit, lies in the nes [ao] and [dm] and gave a measured angle to (100) of 34° 19′ alculated 34° 20′). This form, first observed by Sir Henry A. Miers 1883 on baryte from Chirbury, Shropshire (Nature, London, vol. 29,

[1] Axes of reference ($a : b : c = 0{\cdot}8152 : 1 : 1{\cdot}3136$) and letters as in Dana, stem of Mineralogy, 6th edit., 1892, and V. Goldschmidt, Atlas der Krystall-rmen, 1913, vol. 1.

pp. 29, 124), has been listed as doubtful. I have found it on man crystals from that locality.

The prominent faces of the prismatic crystals often have a som what frosted appearance; and in general habit, and more particular from the presence of the characteristic forms (142) and (322), th crystals resemble those from Wotherton mine, Chirbury, Shro shire.

Mr. Finn's analysis of a transparent crystal gave $BaSO_4$ 98·5 $CaSO_4$ 0·65, $SrSO_4$ 0·18, loss on ignition 0·33 %; specific gravity 4·

Notes on the occurrence of wulfenite at Brandy Gill, Cumberland, and of leadhillite at Drumruck mine, Kirkcudbrightshire.

By Arthur Russell.

[Read November 9, 1933.]

Wulfenite from Cumberland.

IN OCTOBER 1875 the late J. G. Goodchild[1] recorded his then recent discovery of a mineral which he stated 'he believed' to be ulfenite and which he had found on an old mine dump near Carrock ell, Troutbeck, Cumberland. One specimen only was, I believe, und by Mr. Goodchild, and this he presented to the Carlisle Museum, here it has been seen by myself, the label bearing the more precise ocality of Brandy Gill.

Wulfenite is an extremely rare mineral in the British Isles, being nown only as minute crystals from two other localities,[2] namely, igher Pitts mine, Mendip Hills, Somersetshire, and Lauchentyre ine, Gatehouse of Fleet, Kirkcudbrightshire. In the company of r. Percy Blight I endeavoured during the last summer to verify r. Goodchild's observation and we were successful in re-locating e spot and in collecting a number of specimens of the mineral in uestion. These accord with Mr. Goodchild's brief description and actly resemble the Carlisle Museum specimen. The wulfenite ecurs as small—not exceeding $1\frac{1}{2}$ mm. in diameter—honey-yellow, tremely thin platy crystals, flattened parallel to *c* (001) and often arly circular in outline, with a marked tendency to form rosette-te aggregates, and also as irregular outlined scales. No measurable ystals were observed. It is usually intimately associated with, or nplanted on, small, bright green to yellowish-green, tapering pris-atic crystals of pyromorphite; or rests directly on drusy-faced,

[1] J. G. Goodchild, Wulfenite at 'Caldbeck Fell'. Geol. Mag., London, 1875, c. 2, vol. 2, pp. 565–566; also Trans. Cumberland and Westmorland Assoc. dv. Lit. Sci., 1885, no. 9 (for 1883–1884), p. 188.

[2] L. J. Spencer, Min. Mag., 1923, vol. 20, p. 88.

more or less iron-stained quartz, with which are associated sma quantities of galena, cerussite, and chalcopyrite. Anglesite, not by Mr. Goodchild as an associate, was not observed. The miner is optically negative and gives the characteristic micro-chemical tes for lead and molybdenum.

The exact spot where the mineral occurs is a small dump derive from a trial level, three-quarters of the way up Brandy Gill, a trib tary of Grains Gill, and at the confluence of which gills half a mi to the south, the Carrock wolfram-scheelite mine was worked, whi half a mile to the north is Dry Gill mine, the well-known locality f campylite (six-inch Ordnance sheet, Cumberland 47 SE.). The leve the mouth of which has long since been obliterated, was apparent driven between the years 1864–1870 by Messrs. Leicester, Hutchins and Co. with a view to exploring an east and west lead-bearing ve traversing a rotten granophyre and situated between the northe extensions of the north and south Emerson and Harding veins of t Carrock wolfram mine, both of which farther south carry, among oth minerals, molybdenite. Another level has been driven a short distan down Brandy Gill, apparently on the same vein, but the dump sho no trace of wulfenite, and the mineral appears to have been extremely local occurrence.

Leadhillite from Kirkcudbrightshire.

In 1917 I had occasion to visit the small copper mine of Drumruc situated about five miles north of Gatehouse of Fleet, Kirkcudbrigh shire (six-inch Ordnance sheet, Kirkcudbrightshire 41 NW.). T mine had been started by the owner of the property, the la Colonel Murray Baillie of Callay, at the beginning of 1913, and fo levels had been driven in the hill-side on a small and most unpromisi vein containing an occasional string of chalcopyrite in quartz, t enclosing rock being Ordovician slate traversed by a felsite dike. T vein-stuff from the upper level contained a very small quantity alteration products of chalcopyrite and galena, and amongst thes found a single specimen of leadhillite. The specimen consists mai of cavernous galena in part altered to cerussite with very minu crystals of yellow pyromorphite, a trace of linarite, and a good d of chrysocolla, with some malachite and quartz, the cavities bei occupied by small crystals of cerussite and larger crystals of lea hillite.

he leadhillite crystals, one of which was measured on the gonio-
er, are white and translucent, and range up to 5 mm. in diameter.
y are for the most part superimposed and are of the typical six-
l habit, tabular parallel to $c(001)$ which possesses the characteristic
ly lustre, and are bounded by $a(100)$, $m(110)$ with sometimes
-defined $x(111)$.[1]

[1] Letters and indices as in Dana, System of Mineralogy, 6th edit., 1892.

Ettringite from Scawt Hill, Co. Antrim.

By F. A. Bannister, M.A.
Assistant-Keeper in the Mineral Department of the British Museum of Natural History.
With a chemical analysis by M. H. Hey, M.A., B.Sc. and a note on the crystal-structure by J. D. Bernal, B.A.

(With Plate X.)

[Read June 6, 1935.]

ETTRINGITE was the name given by J. Lehmann[1] in 1874 minute, transparent, acicular crystals lining the cavities metamorphosed limestone-inclusions in leucite-nepheline-teph from the Ettringer-Bellerberg, near the village of Ettringen (betw Mayen and the Laacher See), Rhineland. Lehmann detached su cient needles from the limestone for chemical analysis, and fou that they were not gypsum, as formerly supposed, but a hydra calcium sulphoaluminate.

Recently Professor C. E. Tilley[2] recorded ettringite from contact-zone of Chalk and Tertiary dolerite at Scawt Hill, n Larne, Co. Antrim. There it occurs with three other rare miner afwillite, portlandite, and hydrocalumite, as infillings of a lar rock.[3] Sufficient material was isolated to effect a comparison v ettringite from the Laacher See, and to carry out chemical, opti and X-ray investigations. Thence it was hoped to ascertain correct chemical formula, and also to explain the dehydra phenomena of the mineral in terms of its crystal-structure.

In addition to the fresh cleavage fragments[4] of ettringite f Scawt Hill handed to Mr. Hey for chemical analysis, Professor Ti also succeeded in detaching a comparatively well-formed cry which was used for determining the optical and X-ray data. T the largest crystal of ettringite yet found at Scawt Hill, meas

[1] J. Lehmann, Neues Jahrb. Min., 1874, p. 273.
[2] C. E. Tilley and H. F. Harwood, Min. Mag., 1931, vol. 22, p. 444.
[3] C. E. Tilley, Min. Mag., 1934, vol. 23, p. 607.
[4] Perfect prismatic cleavage ($10\bar{1}0$).

$\times 0{\cdot}8 \times 0{\cdot}5$ mm., and has a specific gravity $1{\cdot}772 \pm 0{\cdot}002$ obtained suspending in a mixture of carbon tetrachloride and bromoform. possesses five prism faces of the form m $(10\bar{1}0)$ and one small face $1\bar{2}0)$; no pyramidal or basal faces, however, can be observed, so t the axial ratio and symmetry could only be obtained by X-ray thods. A Lauegram taken along the c-axis reveals an hexagonal s and vertical planes of symmetry, showing that the crystal-ucture is built upon an hexagonal, not a rhombohedral, lattice. ots, however, on one side of the photograph reveal a distortion the crystal. This distortion must be restricted to a twist about c-axis, since the layer-lines of a rotation photograph about this s are truly aligned. Owing to this distortion of the crystal, ation photographs about the $[10\bar{1}0]$ and $[11\bar{2}0]$ axes are slightly s-set but yield consistent and fairly accurate values for the a-cing. The unit-cell dimensions obtained from rotation photo-phs are a $11{\cdot}24 \pm 0{\cdot}02$, c $21{\cdot}45 \pm 0{\cdot}05$ Å. The calculated axial io is therefore $a : c = 1 : 1{\cdot}908$. The axial ratios obtained from iometric measurements of ettringite from Ettringer-Bellerberg, cher See, by Lehmann and more recently by R. Brauns[1] should doubled to correspond with the true lattice dimensions. Their ues, c 0·94345 and 0·9946, then become c 1·8869 and 1·9892.

The crystal of ettringite used for X-ray work offers two prisms able for refractive index measurements. The refracted images monochromatic source were, however, too weak to be observed, the minimum deviation method yielded results only for white t, $\omega = 1{\cdot}4655 \pm 0{\cdot}0005$, $\epsilon = 1{\cdot}4618 \pm 0{\cdot}0005$, $\omega - \epsilon = 0{\cdot}0037 \pm$ 002. Table I gives all the available optical data and specific ity determinations of ettringite. Data for artificial ettringite,[2] roduct of interest in the chemistry of Portland cement, are uded, although X-ray confirmation of its identity with the ural mineral is lacking.

chemical analysis of cleavage fragments of ettringite, approxi-e specific gravity 1·78, from Scawt Hill was then carried out by Hey giving the results shown in table II. The chemical and cal data so far obtained are in fair agreement with Lehmann's Brauns's for ettringite from Ettringer-Bellerberg, Laacher See.

R. Brauns, Die Mineralien der Niederrheinischen Vulkangebiete. Stuttgart, ; p. 173. [Min. Abstr., 2–24.]

W. Lerch, F. W. Ashton, and R. H. Bogue, Bureau of Standards Journ. arch, Washington, 1929, vol. 2, p. 715.

Tilley's identification of the Scawt Hill ettringite was finally pla beyond doubt by X-ray methods. Fortunately a specimen labe ettringite, Winfeld stream, Ettringer-Bellerberg, from J. Lehma private collection has been preserved in the Mineral Departmen the British Museum. Several cavities in the matrix of this speci

TABLE I. Optical data for ettringite.

	Refractive indices ω.	ϵ.	Birefringence $\omega - \epsilon$.	Specific gravity.	Localit
Bannister ...	1·4655	1·4618	0·0037	1·772	Scawt H
Brauns * ...	1·4661	1·4612	0·0049	1·791	Ettring
Lehmann ...	—	—	—	1·7504	Ettring
Lerch, et al. ...	1·464	1·458	0·006	1·48 †	Artificia

* Values for sodium light; Brauns (1922) also gives ω red 1·4642, ϵ red 1·4 ω green 1·4726, ϵ green 1·4673.

† Probably a misprint for 1·78.

are lined with minute crystals in various stages of alteration. M of them are coated with a white opaque substance, and only a longed search revealed a few perfectly clear prisms with nega elongation and refractive indices less than olive-oil. The f crystals show the forms[1] (10$\bar{1}$0) and (10$\bar{1}$1) or (10$\bar{1}$0) and (10 and one of these yielded a rotation photograph about the *c*-

TABLE II. Chemical analysis of ettringite (0·2073 gram) from Scawt Hil Co. Antrim.

	Percentages.	Mol. parts.	Oxygen %	Calc. comp. % *
CaO ...	26.6	0·474	7·59	26·81
Al_2O_3 ...	7·0	0·069	3·30	8·12
SO_3 ...	18·8	0·235	11·27	19·14
CO_2 ...	0·8	0·018	0·58	—
H_2O ...	46·3	2·57	41·12	45·93
Total ...	99·5		63·86	100·00

* Calculated for the formula $6CaO.Al_2O_3.3SO_3.32H_2O$.

identical with that of the Scawt Hill crystal. Rotation photogr of the altered crystals do not show the characteristic ettringite tern but broad faint spots due to an oriented pseudomorph of g size less than 1×10^{-6} mm.; the *c*-spacing is approximately These have refractive indices near to xyloï. Larsen's values ϵ 1· ω 1·488 were probably obtained on similarly altered material. sibly Brauns's axial ratio, which is considerably higher

[1] The recorded forms for ettringite are *c* (0001), *m* (10$\bar{1}$0), *r* (10$\bar{1}$1), *p* (and *o* (10$\bar{1}$4) [$a : c = 1 : 1{\cdot}908$]; the form *r* was first noted by R. Brauns (1

ehmann's and the X-ray value, was also deduced from measure-ents on slightly altered crystals.

Having established the identity of ettringite from Scawt Hill with esh ettringite from the original locality, it is possible to employ r. Hey's analysis together with the specific gravity and X-ray data seek a more correct chemical formula for the mineral than has therto been possible. Proceeding in the usual way, the number oxygen atoms per unit cell (excluding the water content) is 36. ience the number of atoms of calcium, aluminium, sulphur, and

TABLE III. Atomic contents of the unit cell of ettringite.

	Ca.	Al.	S.	C.	H_2.
Hey	12·0	3·5	6·0	0·5	65·1
Brauns	12·0	4·6	5·7	—	62·6
Lehmann	12·2	3·8	6·0	—	63·9
Moses	12·0	4·0	6·0	—	62·3
Artificial*	11·7	4·74	5·75	—	62·6

* Analysis performed in the chemistry division of the Bureau of Standards, ashington.

drogen in the unit cell of ettringite from Scawt Hill can be calcu-ted. All the available chemical analyses of ettringite have also en recalculated assuming 36 oxygen atoms per unit cell (excluding e water content), table III. Moses has recorded a mineral he identi-d with ettringite from Tombstone, Arizona.[1] He gives no optical ta, and his values of specific gravity 1·37 and 1·55 were perhaps termined on impure material. A specimen of so-called ettringite om Tombstone, Arizona, in the mineral collection of the British useum has been identified by X-ray and optical methods with lotrichite. Moses's chemical analysis, however, has been included the present study, and leads to values in agreement with those r ettringite from Ettringen and Scawt Hill. In reviewing the data table III it must be remembered that no analysis has yet been ade on more than 0·4 gram of this rare mineral, so that only round mber agreement can be expected. It may, however, be safely ncluded that the unit cell of ettringite contains $12CaO.2Al_2O_3.6SO_3$ d probably $64H_2O$ when fully hydrated.

When a rock-slice containing ettringite from Scawt Hill is mounted Canada balsam and not heated above 110° C. the mean refractive dex rises to 1·50 and the material becomes uniaxial positive. ie reaction is reversible providing the material is left in moist air

[1] A. J. Moses, Amer. Journ. Sci., 1893, ser. 3, vol. 45, p. 489.

for a sufficiently long period. Lerch, Ashton, and Bogue have followed the dehydration of artificial ettringite and found that the change of optic sign accompanies a change in composition from $6CaO.Al_2O_3.3SO_3.31H_2O$ to $6CaO.Al_2O_3.3SO_3.7H_2O$. Table IV shows the calculated percentage of the water lost by ettringite heated to 110° C. and at a red-heat, assuming that fully hydrated ettringite contains 64 molecules of water per unit cell and that dehydration at 110° C. results in a loss of 48 molecules. The experimental values of Lehmann and Moses are in fair agreement.

TABLE IV. Dehydration of ettringite.

	Theoretical.	Lehmann.	Moses. (*a*)	Moses. (*b*)
% Loss at 110° ...	34·4	—	34·53	32·68
,, 120° ...	—	33	—	—
,, 150° ...	—	34	—	—
,, 200° ...	—	36	—	—
,, Red-heat ...	45·9	45·8	45·41	48·44

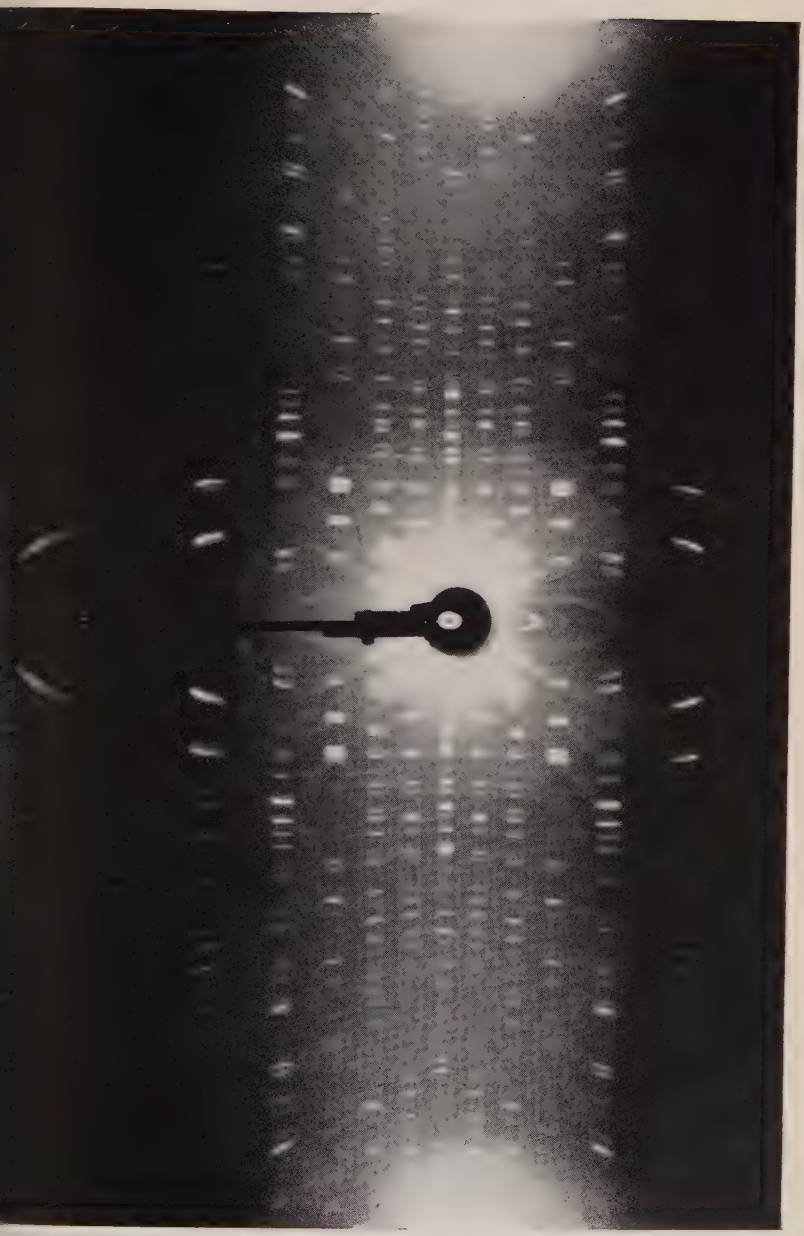
Single crystals of ettringite which have been dehydrated at 110° C do not yield the distinct X-ray pattern characteristic of the untreated mineral. The diffraction spots are diffuse, showing that the grain size of the material must be less than 1×10^{-6} mm. The original ettringite has dehydrated to an oriented pseudomorph with approximate cell sides *a* 8·4, *c* 10·21 Å. and space-group $C6/mmc$. Thus the *c*-axis is approximately halved. The odd layer-lines of a rotation photograph of ettringite about the *c*-axis are weak, so that dehydration corresponds to a sideways shrinkage of the lattice but very little change along the *c*-axis. It should be noted that the altered crystals of ettringite from Ettringen are not identical with dehydrated ettringite. Neither the optical sign nor the X-ray patterns are the same.

The rotation photograph of ettringite reproduced in plate x is a good example of arrangement of diffraction spots in row-lines as well as layer-lines, and was readily indexed. The missing spectra are of the type $(h\,h\,\overline{2h}\,l)$ when l is odd, and a photograph about the *a*-axis reveal that odd orders of $(000\,l)$ are also missing. Assuming the presence of a plane of symmetry parallel to (0001) the space-group is therefore $C6/mmc = D^6_{4h}$. The contents of the unit cell, *a* 11·24 *c* 21·45 Å., are shown from table III to be $12CaO.2Al_2O_3.6SO_3.64H_2O$. It is natural to assume that the crystal-structure of ettringite will contain SO_4 groups, and that the aluminium atoms will be enclosed in octahedral groups $Al(OH)_6$. The structural formula of ettringite

ould then be written $Ca_{12}Al_4(OH)_{24}(SO_4)_6.52H_2O$. Mr. Bernal has roposed a structure of 'zeolitic' type for ettringite based upon the pace-group $C6/mmc$. Approximate atomic co-ordinates have been uggested for all the atoms compatible with their ionic radii and 8 water molecules are located in the channels parallel to the axis [0001]. Such a structure on dehydration would change to $a_{12}Al_4(OH)_{24}(SO_4)_6.4H_2O$, the zeolitic channels would collapse side-ways, but the structure would preserve essentially the same pattern long the c-axis. Preliminary calculations of structure-factors for iffractions of the type $(000l)$ and $(h\,h\,\overline{2h}\,0)$ are not, however, in atisfactory agreement with the observed intensities, suggesting that he contributions of the zeolitic water molecules cannot be neglected. t is hoped to carry out shortly a more rigorous X-ray analysis of ttringite by the Weissenberg method. When this is completed a nore detailed discussion of the structure will be given.

Explanation of Plate X.

Rotation photograph of a crystal of ettringite from Scawt Hill, Co. Antrim, bout the c [0001] axis (set horizontally on the page); taken with filtered copper adiation $\lambda = 1{\cdot}539$ Å., and with a cylindrical camera, diameter 6·04 cm. Actual ize. Note the regular arrangement of spots in vertical rows and horizontal lines. A portion of this photograph was reproduced for the first time in Sir W. H. Bragg and W. L. Bragg, The Crystalline State, London, 1933, vol. 1, plate IV acing page 30.



F. A. Bannister : X-ray Photograph of Ettringite

MINERALOGICAL ABSTRACTS

(Vol. 6, No. 6, June, 1936.)

Notices of Books.

ucas (A.). *Ancient Egyptian materials and industries.* Second edition. London (Edward Arnold & Co.), 1934, xii + 447 pp. Price 16*s*.

This useful work of reference contains chapters on building aterials; metals and alloys; precious, semi-precious, and other nes; painting materials; pottery-making and glass-making. An pendix gives chemical analyses, among which will be found some gypsum, chrysocolla, natron from Wâdi Natrûn and El Kâb, and ss, glazes, mortar, plaster, and objects of copper, silver, gold, and ctrum from Egyptian tombs. The author remarks that the yptian alabaster is calcite, and thinks it probable that the Egyptian terial has the prior claim to the name of alabaster. The use of hydrite for small vases is recorded. The material is pale blue and t been assumed to be marble. The origin of the name electrum the gold-silver alloy is discussed. It is usually stated that the y was called electrum because of its resemblance in colour to ber (electron), 'though since the alloy was probably the earlier own, the reverse seems likely to have been the case'. There is at st one instance of meteoric iron having been used for beads of dynastic date; an analysis by C. H. Desch showed 7·5 % nickel .A. **5**–151]. W. C. S.

me (W. F.). *Geology of Egypt.* Vol. 2, *The fundamental pre-Cambrian rocks of Egypt and the Sudan; their distribution, age and character.* Part 1, *The metamorphic rocks.* 1934, xxxix + 300 + 124 (index) pp., 97 pls., 2 text-figs. Part 2, *The later plutonic and minor intrusive rocks.* 1935, pp. i-xxxv + 301–688 + 1–107 (index), 69 pls., 2 text-figs. Survey of Egypt, Cairo (Govt. Press), 1934–35. Price P.T. 300 [= £3 1*s*. 6*d*.] each part.

In many ways this is a remarkable work. Vol. 1, published in 25, dealt with the surface features (physiography) of the country. l. 2 (of which a third part dealing with minerals of economic value romised) still finds us in the pre-Cambrian period of geology, some 00,000,000 years ago. The set of handsome volumes is well printed t on translucent paper) and profusely illustrated. The illustrations

are indeed a special feature, comprising clear maps (of which the Surv of Egypt may well be proud), fine reproductions in sepia of landscap and beautiful colour reproductions of hand-specimens and mic sections of rocks. The two parts recently issued are mainly pet graphical, dealing with a great variety of rocks. Previous authors quoted *in extenso*, rather breaking up the continuity of the text. the attempt to include every little detail the main issue is confus for reading and for ready reference. The same applies to the ov elaborated index, which contains many unessential details and oc pies 221 pages in the two parts. L. J. S.

[Fersman (A. E.)] Fersmann (A.). *Geochemische Migration der E mente und deren wissenschaftliche und wirtschaftliche Bedeutu* Abhandlungen zur praktischen Geologie und Bergwirtschaf lehre. Herausgegeben von Prof. Dr. Georg Berg. Band Verlag von Wilhelm Knapp, Halle (Saale). Teil I, 1929, 116 p 4 pls., 22 text-figs.; Teil II, 1930, 86 pp., 8 pls., 17 text-figs.

This is rather an important publication giving a good summary the recent work done by the author and of his ideas in geochemist In Part I, Chapter I deals with the principles of geochemist Chapter II with the agpaitic pegmatites of Kola peninsula includi a detailed account of the genesis of alkali-rocks. In this sec chapter the agpaitic series are compared and contrasted with miaskitic and granitic series and the order of crystallization minerals is outlined. In Part I, Chapter III the geology and g chemistry of the emerald deposits in Ural Mountains is present In Part II, Chapter I deals with the uranium-vanadium deposits Tyuya-Muyun in Turkestan, and Chapter II with the sulphur depo of the Karakumy desert of Central Asia. S. I. T.

[Kupletsky (B.M.)]. Куплетский (Б. М.). Петрография Кольск полуострова. [*The petrography of Kola peninsula.*] Петрогра СССР, под редакцией Акад. Ф. Ю. Левинсона-Лессинга, Сер Региональная Петрография, Вып. I. Петрографический Инст Акад. Наук СССР. [The petrography of USSR, edited by F. Loewinson-Lessing, Series I, Regional Petrography, Vol. Petrographical Institute. Acad. Sci. USSR], Leningrad, 19 152 pp., 1 map, 22 text-figs.

The series 'The petrography of USSR' is planned to incl 'Regional petrography' (17 vols.), 'The rock-forming miner (10 vols.), and 'The rocks' (14 vols.). The present volume is

rst volume of this series and it is written by the best authority on he petrography of the Kola peninsula. It is a clear and compact ummary of a district the systematic survey of which began only after 917. The history of the survey is given, with numerous references o the literature, followed by the account of the geography and eology of Kola peninsula. Rocks of the pre-Cambrian metamorphic omplex with associated acid and basic intrusives are described first. great deal of space is devoted to the post-Silurian alkali intrusive ocks, including the central Kola alkali-granites, Khibina and ovozero nepheline-syenites and associated rocks and the alkali dikes f Turya peninsula. 184 analyses of rocks and minerals are given in eparate tables and a geological map of the district at the end of the olume. Unfortunately there is no index, but possibly it is planned or the whole series. S. I. T.

ETERSEN (W.). *Schwimmaufbereitung.* Wissenschaftliche Forschungsberichte, Naturwissenschaftliche Reihe, Band 36, Dresden & Leipzig (Theodor Steinkopff), 1936, xii + 337 pp., 93 figs. Price RM. 18 (bound 19.50).

This is not a treatise on bathing costumes as might be gathered om the title. The process universally known as flotation or oth-flotation would perhaps be better expressed in German as Schaumschwimmaufbereitungsverfahren'; but some good Germans, membering that *flot* is really a Teutonic root, have used the term otation. This process [M.A. **2**–298, 491] is now very extensively sed in ore concentration, cleaning coal-dust, separating graphite, lphur, &c. Air is blown through a suspension of the finely wdered ore in water together with various frothing agents (oils, aps, xanthates, &c.) and regulating agents (increasing or decreasing e wettability in water of the various minerals present). Certain inerals, depending on the agents used, then come to the surface in e frothy scum. Metallic sulphides, arsenides, and tellurides are adily separated from the gangue minerals; and now the process is tended to oxidized ores, and for separating non-metallic minerals, g. fluorite and baryte from quartz, apatite from nepheline [M.A. **6**–2], &c. The present volume gives a detailed account of the practice d complex theory of this new process (though mention is made of use by Arabs in the fifteen century). Useful tables are given of the ents to be used in separating different minerals; and a bibliography 856 items includes the extensive patent literature. L. J. S.

Laue (M. *von*) & Mises (R. *von*). *Stereoskopbilder von Kristallgittern, I —Stereoscopic drawings of crystal structures, II.* Berlin (Juli Springer), 1936. Folder with 24 cards and 56 pp. of explan tion. Price RM. 18.

The first set of 24 cards was issued in 1926, also under the nam of Laue and Mises. The present set has been selected by Frau Rehbock-Verständig and G. Menzer, the former responsible for t drawings and the latter for the text. The explanatory text is German and English in parallel columns, the English translati being by G. Greenwood. The sharp line drawings with small ato stand out with remarkable clearness when viewed in the stereosco The 24 structures figured, and described in detail in the text, those of arsenic, selenium, graphite, β-tungsten, niccolite, cinnab PbO, pyrite, CO_2, rutile, anatase, molybdenite, β-quartz, β-cristobali SnI_4, Hg_2Cl_2, KHF_2, calcite, aragonite, perovskite, $Pb(NO_3)_2$, spin K_2PtCl_4, and K_2PtCl_6. [Cf. M.A. **4**–194.] L. J. S.

English (George Letchworth). *Getting acquainted with miner* New York & London (McGraw-Hill), 1934, xi + 324 pp., 1 257 text-figs. Price 15*s*.

This book is the same issue as before [M.A. **6**–50] with a fr title-page pasted in. L. J. S

History and Biography.

Davies (Oliver). *Roman mines in Europe.* Oxford (Clarendon Pre 1935, xii + 291 pp., 6 pls., 6 maps. Price 30*s*.

This is a scholarly work with an abundance of footnotes. I full of information, but is not easy reading. The author has hims visited the sites of many of the old mines, and a large amount information, more or less speculative, has been collected from literature, both the ancient classical and the modern archaeologi and technical. The general conspectus of 62 pages gives a good acco of mining rights, economic aspects, organization, mining and me lurgical methods, &c. Then follows an account of the mines mining in each of the Roman provinces, Italy, Gaul, Spain, Brit Isles, Rhineland and upper Danube provinces, Illyrian provin Dacia, Moesia, Macedonia and Thrace, Greece. Under the British I (pp. 140–164) the following matters and districts are dealt wi Cornish tin, Mendips, Weald, Forest of Dean, west Wales, Carnar and Anglesey, the lead district of the north Welsh border, copper

orth-eastern Wales and Cheshire, Derby lead-mines, iron of central nd north England, Yorkshire lead, Scotland. A detailed topo-raphical index is given, and numerous places are marked on the aps. L. J. S.

)AVIES (O.). *Ancient mines in southern Macedonia.* Journ. Roy. Anthropological Institute, London, 1932, vol. 62, pp. 145–162, 1 pl. (map).

—— *Mining in Greece in pre-classical times.* Rep. Brit. Assoc., 1932, York, p. 374 (abstract).

—— *Bronze age mining around the Aegean.* Nature, London, 1932, vol. 130, pp. 985–987.

The author has visited old workings at many localities in Greece nd gives partial chemical analyses of ores and slags. Gold-washing ppears to have been carried on in the Bronze Age, but intensive ining probably started in the sixth century B.C. and was continued to Roman times. L. J. S.

HOMPSON (R. Campbell). *On the chemistry of the ancient Assyrians.* London (Luzac & Co.), 1925, 158 pp., 6 pls. Price 25*s*.

An interpretation of the Assyrian receipts for making coloured azes and glass, inscribed in cuneiform on clay tablets of the seventh ntury B.C. and excavated at Nineveh. The names and identity of e minerals and pigments used are discussed. The name sapphire is aced to the Assyrian word *ṣipru*, meaning scratching or engraving one. L. J. S.

HOMPSON (R. Campbell). *On some Assyrian minerals.* Journ. Roy. Asiatic Soc. Great Britain, London, 1933, vol. for 1933, pp. 885–895.

Names for minerals in ancient Assyrian texts are identified with tites, haematite, and nodules of pyrite (or 'thunderbolts'). L. J. S.

ARTON (George). *Introduction to the history of science.* Carnegie Institution of Washington, Publication no. 376. Vol. 1, *From Homer to Omar Khayyam*, 1927, xi + 839 pp. Vol. 2, *From Rabbi ben Ezra to Roger Bacon*, 2 parts, 1931, xxxv + 480 pp., pp. i–xvi + 481–1251.

The history of the development of scientific method and knowledge traced through the centuries from the seventh and eighth centuries C. to the second half of the thirteenth century A.D. Under each

half-century details are given under the headings mathematics a astronomy, physics, chemistry, natural history, &c., in differe countries. Numerous biographies are included. The three thi volumes contain a mass of information, and there are good indexe

L. J. S.

Ruska (Julius). *Das Buch der Alaune und Salze. Ein Grundwe der spätlateinischen Alchemie.* Berlin (Verlag Chemie), 193 127 pp. Price RM. 15

The Arabic text is given of a fragment of a book, 'Secret of secrets by the Persian physician and alchemist Abū Bakr Muḥammad il Zakarīyā al-Rāzī [= Rhazes] (860–925 A.D.); and this is compar with later Latin texts, one of which is given in full, together with German translation. The matters dealt with include the souls a spirits of minerals (arsenic, sulphur, and quicksilver); metals (gol silver, iron, copper, tin, lead); glass and stones (here recipes a given for the production of imitation gemstones, turquoise, emeral &c., by fusing metallic salts with glass); talc and marcasite; alu and salts.

L. J. S.

Partington (J. R.). *Origins and development of applied chemistr* London (Longmans, Green & Co.), 1935, xii + 597 pp. Price 4

Historical details are given respecting metals and non-meta (stone, gems, ceramics, glass, pigments, salt, soda, organic, medicin &c.) in each of the following regions: Egypt, Babylonia and Assyri Troy and Cyprus (Aegean civilization), Asia Minor, Phoenicia, a Palestine. Numerous references are given to the literature.

L. J. S.

Donald (M. B.). *History of the Chile nitrate industry.—I.* Ann. S London, 1936, vol. 1, pp. 29–47, 1 pl., 3 text-figs.

The deposits of soda-nitre or 'caliche' extend for 600 miles the sandy desert from Arica to Copiapó. The material had been us locally to a small extent for making glass, gunpowder, and firework and was first shipped about 1820. The presence of iodine w detected in 1840 and it was first produced as a by-product in 18 This paper together with six others appears in the first number of new periodical 'Annals of Science: a quarterly review of the histo of science since the renaissance'.

L. J. S.

ADAMS (Frank D.). *Earliest use of the term geology.* Bull. Geol. Soc. Amer., 1932, vol. 43, pp. 121–123.

—— *Further note on the earliest use of the word "geology".* Ibid., 1933, vol. 44, pp. 821–826.

The word geologia was used by Richard de Bury, Bishop of Durham, in his book 'Philobiblon' (1473), for the study of law, e. matters earthly as distinct from spiritual. In its present sense eologia was used in MS. by the Italian naturalist Ulyssus Aldrovanus (1522–1605). It first appeared in print in M. P. Escholt's Geologia Norvegica', 1657, English translation, 1663; and in nglish in R. Lovell's 'Panmineralogicon or an universal history of inerals' (Oxford, 1661). L. J. S.

dinburgh Geological Society, centenary celebrations. Edinburgh Geol. Soc., 1935, vol. 13, pt. 2, pp. 191–273, 1 pl.

An account of the centenary celebrations in 1934 and of the history the society, which was founded in 1834 by Alexander Rose (whose rtrait is reproduced). Addresses and papers include, amongst others: H. Holland, 'Geology in Edinburgh at the beginning of the nineenth century' (pp. 202–209), reviewing the controversy between eptunists' and 'plutonists'; R. Campbell, 'Mineralogy and petroy' (pp. 242–250). The society commenced the publication of its ansactions in 1868. L. J. S.

BRAUNS (Reinhard). *Das Mineralogische Museum und Institut.* Geschichte der Rheinischen Friedrich-Wilhelms-Universität zu Bonn am Rhein, Bonn (F. Cohen), 1933, vol. 2, pp. 377–385.

The University of Bonn was founded in 1818 and the successive ofessors of mineralogy were J. J. Nöggerath, G. vom Rath, A. vón saulx, H. Laspeyres, and since 1907 R. Brauns [retired 1934 and ceeded by K. Chudoba]. There are good collections of minerals, cks, and meteorites, but these are now deteriorating for want of oper housing. L. J. S.

BATSON (J. Adam). *Crawford Muir: its mining history and minerals.* Trans. Edinburgh Geol. Soc., 1934, vol. 13, pp. 98–105.

A short account of ancient mining for lead and zinc ores and uvial gold in the Leadhills and Wanlockhead district in Scotland, th mention of the minerals that can be found in the old dumps. f. M.A. **4**–468.] L. J. S.

Whitlock (Herbert P.). *A century of progress in crystallograph* Amer. Min., 1934, vol. 19, pp. 93–100. (Presidential address

An outline of the history of crystallography from the time R. J. Haüy to the development of X-ray methods. L. J. S.

Sweet (Jessie M.). *Sir Hans Sloane: life and mineral collectio* Nat. Hist. Mag. (Brit. Mus.), 1935, vol. 5, pp. 49–64, 97–11 145–164, 37 figs.

The miscellaneous collections of Sir Hans Sloane (1660–175 formed the nucleus of the British Museum in 1753. Many of th mineral specimens still bear numbers corresponding to entries in th extensive MS. catalogues. In the three articles interesting accoun are given of: I, Life; II, Mineral collection; III, Mineral pharma ceutical collection. The history has been traced of the origin specimen of columbite, which was sent from Connecticut by Jo Winthrop in 1734. A good account is given of Lemnian earth (ter sigillata) and of some other supposed remedies. L. J. S.

Brindley (W. H.). *Richard Kirwan, F.R.S., 1733–1812.* Natur London, 1933, vol. 132, pp. 957–958.

A short biographical notice. Kirwan's 'Elements of Mineralog (1784) was the first systematic treatise on the subject in English. L. J. S.

William Hyde Wollaston, F.R.S. (1766–1828). Unveiling of memori plaque. Nature, London, 1934, vol. 134, pp. 86–87.

A memorial plaque placed on the house, 14 Buckingham Stree London, W. 1, where W. H. Wollaston lived from 1801 till 182 was unveiled on July 4, 1934, by Sir F. G. Hopkins, President of t Royal Society, who then delivered an address. L. J. S.

Adams (Frank Dawson). *Biographical memoir of Thomas Sterry Hu 1826–1892.* Nat. Acad. Sci. U.S.A., Biographical Memoi 1932, vol. 15, pp. 205–238, 1 pl. (With bibliography a portrait.)

[*Portraits of Canadian mineralogists.*] Univ. Toronto Studies, Ge Ser., 1932, no. 32; 1933, no. 35; 1934, no. 36; 3 frontispiece [Cf. M.A. **5**–244.]

The annual 'Contributions to Canadian mineralogy' for 1932– give portraits of the following: John Jeremiah Bigsby, F.R.S. (179 1881): James Wilson, who for 48 years (1821–69) practised as

ysician in Perth, Ontario; he discovered the minerals wilsonite, thite, and loganite: Henry How (1827–1879) [Min. Mag. **3**–216].
L. J. S.

EEKS (Mary Elvira). *The scientific contributions of Don Andrés Manuel del Río.* Journ. Chem. Education (Amer. Chem. Soc.), 1935, vol. 12, pp. 161–166, 4 figs. (portrait).

A. M. del Río (1764–1849) was born in Madrid and studied at ris, Freiberg, and Schemnitz. In 1794 he migrated to Mexico as fessor of Mineralogy in the School of Mines and in 1834 he was o Professor of Geology. He produced several books on mineralogy l geology, but he is best known as the discoverer of the element adium.
L. J. S.

TTNER (Radim). *O vývoji geologie v Čechach* [Development of geology in Czech.] Sborník Klubu Přírodovědeckého v Praze [Bull. Nat. Sci. Club, Praha], 1931, jubilee volume 'Vývoj české přírodovědy' [Development of Czech natural science], pp. 129–165, 39 pls.

n this historical sketch of geology portraits are given of the owing Czech geologists and mineralogists. Ignaz von Born 42–1791), Wilhelm von Haidinger (1795–1871), Rudolf Helmker (1840–1915), Adolf Hofmann (1853–1913), Bedřich Katzer 51–1925), Josef Klvaňa (1857–1919), Jan Krejči (1825–1887), ntišek Pošepný (1836–1895), A. E. Reuss (1811–1873), František ba (1867–1918), Alfred Slavík (1847–1907), Karel Vrba (1845–72), Victor von Zepharovich (1830–1890), F. X. M. Zippe (1791–53).
L. J. S.

ruccio Zambonini: in memoriam. Napoli, 1934, 166 pp., 1 pl.

collection of obituary notices of F. Zambonini (1880–1932), with rait and bibliography of 165 items. [Cf. Min. Mag. **23**–362.]
L. J. S.

ERBAUM (H. G.). *Jac. Berzelius: levnadsteckning.* 3 vols. 1929–31, Upsala (Kungl. Svenska Vetenskapsakademien), 1676 pp., 26 pls., 16 text-figs.

hese three handsome volumes written in Swedish form a fitting norial to the great Swedish chemist and mineralogist Jöns Jacob elius (1779–1848). Several portraits are given of him, and also raits of J. A. Arfvedson (1792–1841), E. Mitscherlich (1794–3), C. G. Mosander (1797–1858), H. Rose (1795–1864), N. G.

Sefström (1787–1845), L. F. Svanberg (1805–1878), F. Wöhler (180 1882), and others. L. J. S.

Bibliographies.

Holmberg (Arne). *Bibliografi över J. J. Berzelius.—Bibliographie J. J. Berzelius.* Part I, 1933, xii + 152; supplement 19 ix + 37 pp. Part II, 1936, xvi + 222. Kungl. Svenska Vet skapsakademien, Stockholm.

Part I includes printed works—biographies, books, papers. numerous scientific papers were published between 1800 and 18 Part II includes letters and other MSS., and gives an index of t names of persons mentioned in both parts. L. J. S.

Catalogue of the books, manuscripts, maps and drawings in the Brit Museum (Natural History). London (British Museum), 19 vol. 7, supplement J–O, pp. 514–967. Price £2 10*s.*

Vols. 1–5 of the main catalogue were issued in 1903–15 [M 1–82]. Vol. 6 (A–I) commencing the supplement was issued 1922; this volume contains a separately-paged appendix 'Adde and corrigenda' to vols. 1 and 2, but without any indication of presence on the title-page or in the preface. The volumes cont much useful bibliographical detail fixing the names and dates authors, dates of publication, &c. The extensive mineralogi library is included. L. J. S

A world list of scientific periodicals published in the years 1900–19 2nd edit., Oxford (Univ. Press) & London (Humphrey Milfo 1934, xiv + 780 pp. Price £3 3*s.*

Under more than 36,000 numbered entries, together with m cross-references, are given the full titles of the flood of scient periodicals (including also technical and trade journals). A stand system of abbreviated titles is suggested. These are not alw consistent; e.g. '*Amer. Min.*' and '*Miner. Mag.*' Indications given as to where these periodicals (but far from all of them) n be seen in 187 libraries in the British Isles. This is an indispensa work of reference, but it could scarcely ever be made comple some few journals are noticed in these abstracts that have esca its meshes. L. J. S

Strachan (James). *An English bibliography of precious stones (16 1904).* Gemmologist, London, 1933, vol. 3, pp. 21–23.

Eight titles, with some notes, are given of books on precious sto published in English during the 17th and 18th centuries, and thirt

luring the 19th century [unfortunately with several errors, and there re many omissions]. L. J. S.

EONARD (Frederick C.) & WEBB (Robert W.). *Bibliography of meteoritics: second 1935 list.* Popular Astronomy, Northfield, Minnesota, 1935, vol. 43, pp. 658–660.

—— —— —— *first 1936 list.* Ibid., 1936, vol. 44, pp. 47–49. [Cf. M.A. **6**–99.]

Titles of papers and notes arranged under authors for various ears, and not representing the literature for the years 1935 and 936 as suggested in the title. L. J. S.

ubject index to the geological literature added to the Geological Society's Library during the years ended December 31st, 1923 & 1924. [Nos. 26–27], London (Geol. Soc.), 1933, 143 pp. Price 5*s*.

eological literature added to the Geological Society's Library during the year 1932. No. 35, London (Geol. Soc.), 1933, iii + 308 pp. Price 10*s*.

— *year 1933.* No. 36, London (Geol. Soc.), 1934, iii + 303 pp. Price 10*s*.

— *year 1934.* No. 37, London (Geol. Soc.), 1935, iii + 328 pp. Price 10*s*.

The author-indexes nos. 26 and 27 were issued in 1924 and 1925 .A. **3**–230] and the corresponding subject-index for the two years ken together is now issued. A subject-index for the years 1920–22 in preparation. Nos. 35, 36, and 37 give both author- and subject-dexes for 1932–34. This useful work of reference, giving a key to most the whole of geological and mineralogical literature, has been ued as annual volumes since 1895 (for 1894) [M.A. **2**–99, **5**–245]. e publication now ceases, the work being now done on similar es by the Geological Society of America (see following abstract). L. J. S.

CKLES (John M.) & MILLER (Robert B.). *Bibliography and index of geology exclusive of North America.* Vol. 1 for 1933, 1934, Geol. Soc. Amer., xxii + 405 pp.; vol. 2 for 1934, 1935, xxiii + 420 pp.

This new catalogue of geological literature, including also minera-y and petrology, is published by the Geological Society of erica with the aid of the R. A. F. Penrose bequest. It is on the ne lines as the well-known 'Bibliography of North American logy', giving in an alphabetical list of authors the full titles of

papers in the original languages, with an English translation or br explanation of the contents. This is followed by a detailed index subjects and localities. A long list is given of the journals index L. J. S

Nickles (John M.). *Bibliography of North American geology 19 and 1932.* Bull. U.S. Geol. Survey, 1934, no. 858, 300 Price 25 cents. [Cf. M.A. **5**–250.]

3454 numbered titles of papers on geology, including mineralo and petrology, are listed under authors. The detailed index subjects and localities refers back to these numbers. L. J. S

Annotated bibliography of economic geology for 1932. Econ. G Publishing Co., 1933, vol. 5, no. 2, pp. i–viii, 229–431. P $3.00. [Cf. M.A. **5**–245.]

—— *for 1933.* Ibid., 1934, vol. 6, no. 1, viii + 165 pp.; no. pp. i–viii + 167–372.

—— *for 1934.* Ibid., 1935, vol. 7, no. 1, viii + 191 pp.; no. pp. i–viii + 193–382. Price $5.00 a year.

This useful series of short abstracts, grouped under a variety headings, was started for the year 1928 [M.A. **4**–486, **5**–245]. E part (for the half year) contains over a thousand abstracts and index, and is complete in itself; but the pagination runs thro the whole volume, while the abstracts are given two sets of dupli numbers. When consulting the bound volumes a second index m be looked for in the middle. Little idiosyncrasies of this kind m be overlooked by hasty searchers. L. J. S

Nicolas (Frank). *Index to Memoirs 1910–1926, Bulletins 1913–19 Summary Reports 1917–1926, Sessional Papers (administrat 1921–1926.* Geological Survey, Canada, Ottawa, 1932, no. 2 (Misc. ser., no. 3), vii + 666 pp. Price $2.00 (bound $2.50).

A general index of authors, subjects, and localities in one alp betical arrangement. [M.A. **2**–99, 481.] L. J. S

Bibliographie des sciences géologiques. Paris (Soc. Géol. Fran 1933, ser. 2, vol. 3 (for 1932), 356 pp. Price 40 fr. (Fran 50 fr. (abroad).

—— 1934, vol. 4 (for 1933), 388 pp.

—— 1935, vol. 5 (for 1934), 342 pp.

The annual volumes for 1932, 1933, and 1934 are compiled the same lines as previously [M.A. **5**–244]. They contain 4 5202 and 4769 titles respectively. L. J. S

ANDEGREN (R.). *Revue annuelle de la littérature géologique suédoise 1931–1933.* Geol. För. Förh. Stockholm, 1935, vol. 56 (for 1934), pp. 531–595.

—— —— *1934.* Ibid., 1936, vol. 57 (for 1935), pp. 637–661.

Titles of papers are grouped under various headings, including ineralogy and crystallography, ores, petrology, &c. In the case of apers written in the original in Swedish an English or German bstract is added. [M.A. **5**–248.] L. J. S.

ibliografia geologica italiana per l'anno 1930. Boll. R. Ufficio Geol. Italia, 1932, vol. 57, no. 2, 21 pp.

—— *per l'anno 1931.* Ibid., 1933, vol. 58, no. 1, 22 pp.

—— *per l'anno 1932.* Ibid., 1934, vol. 59, no. 1, 21 pp.

— *per gli anni 1915–1933.* Ibid., 1934–35, vols. 59–60, supplements nos. 1–2 (A–B), 188 pp. Price L.5 each number.

The three annual lists for 1930–32 are on the same plan as before .A. **5**–248]. For the longer period 1915–33 abstracts are given papers on the geology, petrology, and mineralogy of Italy pub-hed in Italian and foreign journals. These are arranged under uthors (A–B) in the first two parts. L. J. S.

GNORE (Francesco). *Bibliografia italiana vesuviana dal 1845 ad oggi.* Ann. R. Osservatorio Vesuviano, 1934, ser. 4, vol. 2, pp. 17–140.

A short historical account is given of the work done on Vesuvius nce the time of Monticelli and Covelli. The 'Reale Osservatorio teorologico Vesuviano' was founded in 1845. The long biblio-aphy gives the titles of papers arranged under authors.

L. J. S.

SCHER (W.) & HÄNTZSCHEL (W.). *Neuere Arbeiten zur Mineralogie und Geologie Sachsens.* Sitzungsber. Naturwiss. Gesell. Isis, Dresden, 1933, for 1932, pp. 44–47.

SCHER (W.). *Neue Arbeiten zur Mineralogie und Geologie Sachsens aus den Jahren 1933 und 1934.* Ibid., 1935, for 1933–34, pp. 17–23.

Titles of papers, published in 1932 and 1933–34, arranged alpha-tically according to authors, on the mineralogy and geology of xony. [M.A. **5**–85, 248.]

Bibliographia geologica hungarica. (1930–1933.) Földtani Közl
1934, vol. 64, pp. 366–372.

—— *1934.* Ibid., 1935, vol. 65, pp. 78–80, 152, 276–280.

Titles of papers arranged alphabetically under authors, as
previous years [M.A. **4**–489]. L. J. S

Schwarz (Rudolf) & Procházka (Jan Svatopluk)† [1891–19
Mineralogicko-geologická bibliografie Čsl. republiky za rok 1930-
[Mineralogical and geological bibliography of the Czechoslo
Republic for the years 1930–31.] Věstník Státního G
Ústavu Československé Republiky, 1934, vol. 10, pp. 42–96

The bibliography for the years 1928–29, issued in 1930,
commenced by the late J. S. Procházka, and was completed
several other compilers. In addition to scientific papers, short n
and technical reports are included in an alphabetical list of auth
F. S

Wykaz prac polskich treści krystalograficznej, mineralogicznej i p
graficznej.—Bibliographie cristallographique, minéralogique et p
graphique polonaise. Arch. Min. Tow. Nauk. Warszaw. (A
Min. Soc. Sci. Varsovie), 1933, vol. 9, pp. 152–155; 1934, vol
pp. 243–247; 1935, vol. 11, pp. 183–185. [Cf. M.A. **5**–24

Titles of papers, arranged according to authors, published in 1
with supplements for 1929 and 1931; and in 1933–34. For 1
abstracts are given in French of a few papers. L. J. S

Godlevsky (M. N.) Годлевский (М. Н.). Успехи минералог
Союзе за последние 15 лет. –*The progress of mineralogy in*
U.S.S.R. during last 15 years. Зап. Росс. Мин. Общ. (Mém.
Russe Min.), 1932, ser. 2, vol. 61, pp. 205–226; 1933, se
vol. 62, pp. 269–298.

A review is given of the work done in institutions in diffe
parts of the Union, with a bibliography of 660 titles of papers.
L. J.

Godlevsky (M. N.) & Grigoriev (D. P.) Годлевский (М. Н.) и Григо
(Д. П.). Литература по кристаллографии и минералогии за 19
(СССР.).—*Literature of crystallography and mineralogy for*
(*USSR*). Зап. Всеросс. Мин. Общ. (Mém. Soc. Russe M
1935, ser. 2, vol. 46, pp. 265–271.

This gives 150 titles (in Russian) of papers on crystallography
mineralogy published during 1934, arranged alphabetically u
authors. L. J.

Sobolev (Vladimir)] Соболев (Владимир). Литература по петрографии и петрологии за 1934 год (СССР).—Sobolev (V. S.). *Literature on petrography and petrology in 1934 (U.S.S.R.).* Зап. Всеросс. Мин. Общ. (Mém. Soc. Russe Min.), 1935, ser. 2, vol. 64, pp. 511–518 (Russ.), 518–521 (Engl.).

Titles of papers are grouped under the headings: Igneous and etamorphic rocks by districts (Karelia and Kola, Ukraine, Caucasus, ral, Far East, Siberia and Jakutia, Central Asia and Kazakstan), eneral petrography and petrology, Technical and experimental trography, Sedimentary petrography, and Petrography of coals. he second part gives the titles in English in a condensed form with-ut reference to the periodicals. L. J. S.

нижнина.—*Bibliographie.* Списание на Българското Геологическо Дружество (Review Bulgarian Geol. Soc.), 1932, vol. 4, pp. 167–170.

Titles of papers relating to the geology, petrology, and mineralogy Bulgaria for the years 1930, 1931, and 1932. L. J. S.

ibliography of Uganda geological literature. Ann. Rep. & Bull. Geol. Survey Uganda, for 1933, Entebbe 1934, pp. 82–88.

Titles of papers and reports arranged alphabetically under authors. L. J. S.

dex 1930. Frankreich. J. Orcel. Min. Petr. Mitt. (Tschermak), 1934, vol. 45, pp. 260–262.

dex 1931. Frankreich. J. Orcel. Ibid., 1934, vol. 45, pp. 263–268.

— *Italienisches Sprachgebiet.* F. Millosevich. Ibid., 1933, vol. 44, pp. 241–245.

— *Ungarisches Sprachgebiet.* B. Mauritz. Ibid., pp. 246–248.

— *Deutsches Sprachgebiet. Teil II: Chemische und technisch eingestellte Zeitschriften.* W. Arnold. Ibid., pp. 331–348.

— —— *Teil III: Deutsche Literatur über Mineralogie, Petrographie und Nachbargebiete, die selbständig, nicht in Zeitschriften, erschienen ist. A. Größere Veröffentlichungen.* W. Arnold. Ibid., 422–425. *B. Gedruckte Dissertationen.* A. Himmelbauer. Ibid., pp. 425–426.

— *Finnland.* P. Eskola. Ibid., pp. 427–428.

— *Schweden.* A. Köhler, A. Marchet, & N. Sundius. Ibid., pp. 429–432.

— *Norwegen.* H. Rosendahl. Ibid., pp. 433–436.

—— *Slawisches Sprachgebiet. Zweiter Teil: Polen.* J. Morozewi
Ibid., 1933, vol. 44, pp. 507–511.
—— —— *III. Teil: Tschechoslowakisches Sprachgebiet.* F. Slav
[i.e. Slavík]. Ibid., pp. 512–515.
—— —— *IV. Teil: Jugoslavisches Sprachgebiet.* L. Dolar-Ma
tuani. Ibid., pp. 516–517.
—— —— *V. Teil: Bulgarisches Sprachgebiet.* N. Nikolow. Ibi
p. 518.
—— *Slawisches Sprachgebiet. Erster Teil. Union der sozialistisc
Sowjetrepubliken (Rußland).* O. Schubnikowa-Lebedewa &
Iwanowa. Ibid., 1934, vol. 45, pp. 235–259. [With supp
mentary list of periodicals.]
Index 1932. Italienisches Sprachgebiet. F. Millosevich. Ib
1934, vol. 45, pp. 364–368.
—— *Ungarisches Sprachgebiet.* B. Mauritz. Ibid., pp. 369–372
—— *Deutsches Sprachgebiet. Teil I. Arbeiten aus Gesellschaftsschri
und Zeitschriften allgemeinen Inhaltes, aus besonderen min
logischen, petrographischen und geologischen Zeitschriften.*
Köhler, A. Marchet, & Raaz (F.). Ibid., pp. 478–513.
—— —— *Teil II. Chemische und technisch eingestellte Zeitschrif*
W. Arnold. Ibid., 1934, vol. 46, pp. 212–234.
—— —— *Teil III. Deutsche Literatur über Mineralogie, Petrol
und Nachbargebiete, die selbständig, nicht in Zeitschriften, erschie
ist.* A. Himmelbauer. Ibid., pp. 234–236.
—— *Slawisches Sprachgebiet. Erster Teil. Union der sozialistis
Sowjetrepubliken (Rußland).* O. Schubnikowa-Lebedewa. Ib
1935, vol. 46, pp. 293–318.
—— —— *Zweiter Teil: Polen.* R. Fleszar. Ibid., pp. 319–32
—— —— *Dritter Teil: Tschechoslowakisches Sprachgebiet.* F. Sla
Ibid., pp. 323–327.
—— —— *Vierter Teil: Jugoslavisches Sprachgebiet.* L. Do
Mantuani. Ibid., p. 328.
—— —— *Fünfter Teil: Bulgarisches Sprachgebiet.* N. Nikol
Ibid., p. 329.
Index 1933. Ungarisches Sprachgebiet. B. Mauritz. Ibid., 19
vol. 46, pp. 85–88.
Index 1934. Ungarisches Sprachgebiet. B. Mauritz. Ibid., 19
vol. 47, pp. 80–87.

These indexes, started in 1931 [M.A. **4**–488, **5**–246], are now t
discontinued except for the less easily accessible literature in S

navian, Hungarian, and Slavonic languages. Under a few main bject-headings they give titles of papers arranged alphabetically cording to authors. There is much confusion in the references to riodicals. L. J. S.

AVES (F.) & FAESY (K.). *Hauptregister zu Band 51 bis 75 der Zeitschrift für Kristallographie, Kristallgeometrie, Kristallphysik, Kristallchemie. Sachregister . . .* von K. FAESY; *Autorenregister . . .* von F. LAVES. Leipzig (Akad. Verlagsgesell.), 1933, [ix] + 373 pp. Price 33·60 Mk.

A general index of authors and subjects to vols. 1–50 (1877–1912) the 'Zeitschrift für Krystallographie und Mineralogie' ('Groth's itschrift') was published in 1913–15 [M.A. **1**–82], and a locality-dex to vols. 1–55 (1877–1920) in 1931 [M.A. **5**–85]. At vol. 56 e editorship passed to P. Niggli with change in title to 'Zeitschrift Kristallographie'. The present index to vols. 51–75 (1912–30) ludes original and reprinted papers and a portion of the 'abstracts'. ur different methods of abstracting have been attempted. Straightforward abstracts of each paper (vols. 1–55). (2) A tematic collection of data for elements to organic compounds ls. 56–64) in which matter from any one paper may be widely arated. (3) The 'Strukturbericht' with a separate pagination in is. 65–79 [M.A. **5**–5]. (4) 'Referatenteil', forming four volumes h separate paginations, issued with vols. 66–84 (1928–33). The o separately-paged sections (3) and (4) are not included in this dex. The subject-index is detailed but does not include localities. ere are two author-indexes, one to original papers and the other abstracts—a fact that will in many cases be overlooked on a hasty erence to the volume. Further, owing to the different systems pted in the 'abstracts', many bibliographical anomalies are roduced. L. J. S.

GLOSSMACHER (K.). *Datensammlung gesteinsbildender Mineralien 1930.* Fortschr. Min. Krist. Petr., 1934, vol. 18, pp. 171–268.

—— *für 1931.* Ibid., 1935, vol. 19, pp. 217–298.

—— *für 1932.* Ibid., 1936, vol. 20, pp. 69–142.

This series of collected data on rock-forming minerals was previously en for the years 1927–29 in the abstract section (now discontinued) the 'Zeitschrift für Kristallographie'. The minerals dealt with arranged in the order (cubic to triclinic) adopted in Rosenbusch d Mügge 'Mikroskopische Physiographie' (1927). Under each

mineral or group are given titles and abstracts of original pape
Many chemical analyses are quoted, as well as optical and oth
data. L. J. S.

Niggli (P.) & Brandenberger (E.). *Cristallographie et minéralog*
Tables annuelles de constantes et données numériques, Par
1935, vol. 10 (for 1930), part 2, pp. 914–961.

Mathieu (M.). *Structure de la matière par les rayons X.—Structu*
of matter by X-rays. Ibid., pp. 962–1006.

Continuations on the same lines as before [M.A. **5**–246] giving
digest of the literature for the year 1930. L. J. S.

New Minerals.

[Starik (I. E.) & Segel (N. M.)] Старик (И. Е.) и Сегель (Н. М
Радиохимический анализ минерала из группы ниобо-титанат
[*Radiochemical analysis of a mineral of the niobo-titanate grou*
Труды Централ. Геохимической Лаборатории [Trudui Cent
Geochemical Laboratory], Leningrad & Moscow, for 1931, 19
pp. 43–50 (Russ. with Engl. summary).

[Starik (I. E.)] Старик (И. Е.). Свинцовый метод определе
возраста пород.—Starik (I. E.). *The lead method for the determi*
tion of geological time. Проблемы Советской Геологии (Proble
of Soviet Geology), 1933, vol. 3, no. 7, pp. 70–77 (Russ.), p.
(Engl. summary).

In an account of the methods of analysis for the determination
the age of minerals from the ratios of Ra, U, Th, Pb, He, the follow
analysis is given of an incompletely determined mineral, which in
second paper is named *khlopinite* (p. 74, хлопинит; p. 78, chlopin
after Prof. V. G. Khlopin. [Further scanty details are given
O. M. Shubnikova and D. V. Yuferov, Report on new miner
Leningrad, 1934, p. 104 (M.A. **6**–51), where the name is sp
хлопинит and hlopinite, still another transliteration.] Nb_2O_5 39·
Ta_2O_5 7·37, TiO_2 10·01, SiO_2 0·61, UO_2 8·12, ThO_2 2·22, Y_2O_3 17
Fe_2O_3 8·16, FeO 1·83, MnO 0·26, MgO 0·13, CaO 0·96, PbO 0·
BeO 0·03, K_2O+Na_2O 0·24, H_2O 2·94 = 100·64. The formula
$M_2Nb_2TiO_9.H_2O$ and the mineral is compared with polycrase. I
black, optically isotropic, and strongly radioactive; sp. gr. 5
$n > 1·768$; easily fusible and decomposed with difficulty by H_2S
It occurs with monazite and felspar at Khilok (Хилок) in Tra
baikal, Siberia. L. J. S.

Syromyatnikov (F. V.)] Сыромятников (Ф. В.). Термический анализ хризотил-асбеста.—Syromjatnikow (F. W.) *Thermische Analyse von Chrysotil-Asbest.* Бюлл. Москов. Общ. Испыт. Природ. (Bull Soc. Nat. Moscou), 1934, new ser., vol. 42 (Geol. Sect. vol. 12), pp. 137–147 (Russ.), pp. 147–149 (Engl. summary), 1 pl., 5 text-figs.

—— Классификация, номенклатура и идентификация минералов группы хризотила.—Syromyatnikov (F. V.). *Classification, nomenclature and identification of minerals of the chrysotile group.* Ibid., pp. 563–573 (Russ.), p. 574 (Engl. summary), 2 figs.

Differences in the well-marked peaks in the heating-curves and in the X-ray patterns of material before and after heating to various temperatures enable several varieties of chrysotile-asbestos to be distinguished. α-Chrysotile is the most widely distributed form and the one most generally used industrially. β-Chrysotile is the slip-fibre variety characterized by a higher content of silica, $H_{16}Mg_{12}Si_9O_{38}$, with an imperfect fibrous structure, and differing in optical properties. γ-Chrysotile is the rock-forming variety, distinguished from vein-chrysotile by its higher refractive index and somewhat different chemical composition. δ-Chrysotile (or *ishkyldite*) differs from α-chrysotile in having an X-ray spacing *c* 9·68 Å. almost double that of chrysotile (*c* 5·40 Å.) and in its optical properties. α-Chrysotile is further divided into ferruginous and non-ferruginous varieties. The presence of iron, as the ferro-chrysotile molecule, gives rise to brittleness of the fibre. L. J. S.

Syromyatnikov (F. V.). *The mineralogy of asbestos: ishkyldite, a new structural variety of chrysotile.* Amer. Min., 1936, vol. 21, pp. 48–54, 2 figs.

Chrysotile-asbestos in serpentine near Ishkyldino (Orskho-Khalilovo region, middle Volga) includes two slip-fibre types: one classed as β-chrysotile; and the other, very like actinolite-asbestos in appearance, which is now named ishkyldite. This is pale bluish-green and finely fibrous, with sometimes a platy parting. Analysis gave SiO_2 42·49, TiO_2 trace, Al_2O_3 1·27, Cr_2O_3 trace, Fe_2O_3 2·01, FeO 2·73, NiO 0·38, MnO 0·06, MgO 38·28, CaO 0·00, $Na_2O + K_2O$ 0·02, CO_2 0·35, H_2O+ 11·88, H_2O- 0·79, volatiles 0·04 = 100·30, showing an excess of 3 % SiO_2 over the serpentine formula, and corresponding with $H_{20}Mg_{15}Si_{11}O_{47}$. Sp. gr. 2·62. The optical characters show an approach to those of antigorite; α 1·566, γ 1·573, 2V 58°, negative;

optic axial plane parallel to the fibres, $Bx_a \perp$ parting. The X-ra pattern is distinct from that of α-chrysotile and the spacing (9·68 Å along the fibres is nearly twice as great. The dehydration curve shov distinctive peaks. L. J. S.

Henderson (Edward P.). *Steigerite, a new vanadium mineral.* Amc Min., 1935, vol. 20, pp. 769–772.

Concretions of corvusite [M.A. **5**–293] in sandstone from Gypsu Valley, San Miguel Valley, Colorado, contain fissures extending in the surrounding sandstone and filled with steigerite, fervanite [M. **4**–498], and gypsum. The steigerite is a canary-yellow amorpho powder with n 1·700–1·715; analysis gave V_2O_5 44·44, Al_2O_3 25·1 Fe_2O_3 1·50, $H_2O + 110°$ 21·04, $H_2O - 110°$ 8·08 = 100·20, agreei with $Al_2O_3.V_2O_5.6\frac{1}{2}H_2O$. Artificial steigerite was prepared by t diffusion of solutions of calcium vanadate and aluminium sulphate L. J. S.

Peacock (M. A.). *On wollastonite and parawollastonite.* Amer. Jou Sci., 1935, ser. 5, vol. 30, pp. 495–529, 17 figs.

Measurements of wollastonite crystals from Crestmore, Californ [M.A. **1**–21], show them to be triclinic with $a:b:c = 1·0816:1:0·964$ α 90° 0′, β 95° 16′, γ 103° 22′. Crystals in limestone blocks fr Monte Somma, Vesuvius, were mostly monoclinic ($a:b:c = 1·052$ 1 : 0·9649, β 95° 24½′), but some were triclinic, and a few consist of an intergrowth of the two kinds. In both kinds the angles a cleavages ((100), ($\bar{1}$02), (001), (101), ($\bar{1}$01)) in the prism-zone a identical; and the optical data are the same, except that in t triclinic crystals the extinction is 2½° to the b-axis. X-ray photograp of the triclinic crystals show a lack of symmetry about the b-axis. T name wollastonite is reserved for the more common triclinic form, a the monoclinic form is called *parawollastonite*. A third modification $CaSiO_3$ is pseudo-wollastonite [Min. Mag. **23**-216]. The wollaston group of triclinic minerals includes bustamite, vogtite [M.A. **5**–52 pectolite [M.A. **6**–95], schizolite, and rosenbuschite. L. J. S.

Bowen (N. L.). "*Ferrosilite*" *as a natural mineral.* Amer. Jou Sci., 1935, ser. 5, vol. 30, pp. 481–494, 2 figs.

Minute (0·05 × 0·005 mm.), colourless or faintly yellow, acicu crystals were found, together with anorthoclase, cristobalite, fayali and biotite, in the lithophysae of an obsidian (SiO_2 75·55 %, n 1·4 from Lake Naivasha, Kenya Colony. These are monoclinic with a pri angle of 90° 50′; α 1·763, β only slightly greater, γ 1·794, $c:\gamma = 34$

V very small, optic axial plane probably (010). From these data is concluded (by extrapolation in the systems $CaSiO_3$–$FeSiO_3$ and $MgSiO_3$–$FeSiO_3$) that the crystals have the composition $FeSiO_3$, and ne mineral is named *clinoferrosilite* [cf. Min. Mag. **24**–225]. It had een previously asserted that $FeSiO_3$ does not exist [M.A. **5**–252, 54], and these systems are now discussed afresh. Similar crystals ere also found in lithophysal obsidians from California, Wyoming, nd Iceland. Chemical analyses are given of these obsidians.

L. J. S.

ALACHE (Charles). *The minerals of Franklin and Sterling Hill, Sussex County, New Jersey.* Prof. Paper U.S. Geol. Survey, 1935, no. 180, vi + 135 pp., 20 pls., 199 text-figs. [Cf. M.A. **4**–182.]

Detailed accounts are given of 148 minerals from this unique ineral locality. Thirty of the minerals recorded from there have t been found elsewhere. In addition to details collected from the erature, many new crystallographic and optical data and some w chemical analyses are given; and two new species are established. *ydrohetaerolite*, $2ZnO.2Mn_2O_3 \cdot H_2O$, tetragonal (?), as distinct from taerolite ($ZnO.Mn_2O_3$). *Magnesium chlorophoenicite*, $(Mg,Mn)_3As_2O_8 \cdot (Mg,Mn)(OH)_2$, monoclinic, differing from chlorophoenicite [M.A. **2**–37] in containing magnesium in place of zinc. The plates give tographic reproductions of fine mineral specimens, but natural es of these are not always indicated; and the numerous text-figures e drawings of crystals. Lists of crystal-forms are given, but the ial ratios to which they are referred are in many cases not stated. bibliography of over 285 entries is arranged under years from 10 to 1934. L. J. S.

AMDOHR (Paul). *Vorkommen und Eigenschaften des Herzenbergits.* Zeits. Krist., 1935, vol. 92, pp. 186–189.

The kolbeckine of R. Herzenberg [M.A. **5**–199] is renamed herzenrgite, as the former name was preoccupied [M.A. **3**–472]. The neral from the Maria Teresa mine, Huari, Bolivia, gives an X-ray wder photograph identical with that of artificial SnS. It is very nilar to teallite and franckeite in appearance, but under the tallographic microscope it shows differences. Optically anisopic; hardness about 2. Herzenbergite also occurs in small nount as an alteration product of nordenskiöldine [M.A. **6**–46] in e Stiepelmann mine near Arandis in South-West Africa. L. J. S.

Hofmann (Wilhelm). *Die Struktur von Zinnsulfür und Teallit*
Fortschr. Min. Krist. Petr., 1935, vol. 19, pp. 30–31.

—— *Ergebnisse der Strukturbestimmung komplexer Sulfide. I. Die Struktur von Zinnsulfür SnS und Teallit $PbSnS_2$. II. Beitrag zur Kristallchemie der Sulfosalze des Arsens, Antimons und Wismuts.* Zeits. Krist., 1935, vol. 92, pp. 161–185, 4 figs.

Crystalline stannous sulphide (*herzenbergite*) was prepared as a graphite-like powder by heating precipitated SnS in fused $SnCl_2$; larger crystals were obtained by the action of H_2S on $SnCl_2$ in HCl solution under pressure. The teallite examined was from Carguaicollo, Bolivia. Both these substances are orthorhombic with platy pseudo-tetragonal habit and perfect basal cleavage, and they represent a new type of structure for compounds AB. The unit cell of SnS has dimensions a 3·98, b 4·33, c 11·18 Å. ($a:b:c = 0{\cdot}944:1:2{\cdot}647$) with four molecules; and of teallite a 4·04, b 4·28, c 11·33 Å. ($a:b:c = 0{\cdot}919:1:2{\cdot}582$) with two molecules; space-group V_h^{11}. The dimensions show a relation to those of galena d_{110} 4·19, $2c$ 11·86 Å.). [Cf. Min. Mag. **14**–21, **19**–117.]

The positions of the sulphur and metal atoms in complex sulphosalts are discussed. In stibnite and wolfsbergite [M.A. **5**–311, 465] there are chains of SbS_3 pyramids, and this seems to be related to the acicular habit of the crystals; and chains of PbS_6 octahedra and CuS_4 tetrahedra may have the same effect in other minerals.

L. J. S.

Colour of Minerals.

[Vernadsky (V. I.)] Вернадский (В. И.) О цветности алюмосиликатов —Vernadskij (V.) (Vernadsky (W.)). *Sur la coloration des alumosilicates.* Докл. Акад. Наук СССР (Compt. Rend. Acad. Sci. URSS), 1932, pp. 107–124.

The hypothesis is based on the author's theory of aluminosilicates, according to which certain aluminosilicates contain a stable 'kaolinite nucleus', $Al_2Si_2O_7$. The colour of certain minerals is due to the association of this 'kaolinite nucleus' (or its hydrate or salt) with a radicle such as NaCl, $CaCO_3$, Na_2SO_4, &c. The 'kaolinite nucleus' is called a 'chromophoric group', and the suggestion is made, that the absorption bands of this group, situated in the invisible parts of the spectrum, are shifted to the visible part on association with a definite radicle.

S. I. T.

ANDREEV (V. N.)] Андреев (В. Н.). Некоторые опыты по искусственной окраске волынских топазов.—ANDREEW (W.). *Quelques expériences sur la colorisation artificielle des topazes de Volhynie.* Труды Ломоносов. Инст. Акад. Наук СССР (Trav. Inst. Lomonossoff, Acad. Sci. URSS), 1935, no. 6 (sér. cryst.), pp. 45–60 (Russ. with Fr. résumé), 6 figs.

Pale blue topaz from Volhynia on exposure to the α-rays from adium or to X-rays changes to yellow of various shades. Yellow opaz shows slight differences in colour and pleochroism on exposure o radium emanation. The colours so acquired are destroyed by eat, ultra-violet rays, or sunlight. Colourless quartz from the Urals ecame dark grey on exposure to radium emanation, and a green ourmaline was in parts changed to pink. L. J. S.

PRZIBRAM (Karl). *Bemerkungen über das natürliche blaue Steinsalz. IV. Wachstumsgeschwindigkeit und Farbe.* Sitz.-ber. Akad. Wiss. Wien, Math.-naturwiss. Kl., Abt. IIa, 1934, vol. 143, pp. 489–497, 1 pl., 5 text-figs. [Cf. M.A. **4**–253.]

Blue rock-salt from Heringen, Werra valley, Thuringia, shows yramids of growth marked by different colours. In those sectors here there has been a more rapid growth along one cubic axis the olour is darker and more blue; whilst in the sector of slower growth he colour is paler and more violet. These differences in colour are scribed to distortion of the lattice during growth. L. J. S.

OSHIMURA (Jun). *The absorption spectra of naturally coloured fluorites.* Sci. Papers Inst. Physical & Chem. Research, Tokyo, 1933, vol. 20, no. 412, pp. 170–177, 2 pls., 2 text-figs.

Absorption bands in the visible and ultra-violet spectrum are oted for fluorites of various colours from Japanese localities. hese bands may be due to the presence of rare-earths. But it is ggested that variations in the position of maximum absorption ay be due to the degree of dispersion of a colloidal substance erhaps metallic calcium); the particles being larger in pink fluorite an in green, and finer than those in violet. L. J. S.

ABERLANDT (Herbert) & SCHIENER (Alfred). *Über Farbverteilungen beim Fluorit in ihrem Zusammenhang mit dem Kristallbau.* Zeits. Krist., 1935, vol. 90, pp. 193–214, 18 figs.

A detailed study of the colour distribution in cleavage plates of uorite and a discussion of various theories that explain the observed henomena. F. A. B.

Arsandaux (H.). *Observations sur quelques fluorines violettes.* Bull. Soc. Franç. Min., 1935, vol. 58, pp. 268–277.

Deep-violet fluorite from l'Isle quarry, Limoges, Haute-Vienne, containing a trace of manganese does not fluoresce in ultra-violet light but is strongly thermoluminescent. The mineral loses its colour when heated, and then becomes markedly fluoresce in ultra-violet light. A detailed account of experiments with violet fluorites from other localities is also given. F. A. B.

Kennard (T. G.). *Spectrographic examination of smoky and ordinary quartz from Rincon, Calif.* Amer. Min., 1935, vol. 20, pp. 392–399, 1 fig.

Spark spectra of carefully prepared samples of colourless, pale smoky, and dark smoky quartz showed the lines of Li, Al, V, Ti, Ca, Mg, Si. The only difference was that the colourless and pale smoky material contained more lithium than the dark smoky. No explanation of the colour can be offered. All the material contained minute (0·002 mm.) inclusions. L. J. S.

Bruce (E. L.). *A spectrographic examination of quartz from some gold bearing veins.* Trans. Roy. Soc. Canada, 1934, ser. 3, vol. 28, sect. 4, pp. 7–11, 2 pls.

Grey, black, and bluish quartz from several Canadian localities are often richer in gold than the ordinary white vein quartz. These are decolorized by heating, and the colour is often restored by exposure to X-rays. Since arc spectra of the material give no clue as to the colouring matter (white quartz gave the same lines), it is suggested that the colour may be due to the presence of atoms of silicon set free by radioactivity [M.A. **3**–117]. This may perhaps also have given rise to the richer deposition of gold. L. J. S.

Thugutt (Stanisław Józef). *Ultramikroskopowe badania kryształów kwarcowych w związku zu ich barwą i genezą.—Études ultramicroscopiques des cristaux de quartz en connexion avec leur origine et leur couleur.* Arch. Min. Tow. Nauk. Warszaw. (Arch. Min. Soc. Sci. Varsovie), 1935, vol. 11, pp. 1–8 (Polish), pp. 9–11 (French résumé), 1 pl.

Quartz is soluble in pure water at 220° C. to the extent of 0·6 gram per litre, and the solution is colloidal. When crystallized from such a solution quartz will contain colloidal particles. For this reason thin sections of clear crystals of hydragenetic quartz show a multitude of bright points under the ultramicroscope: on the other hand

artz of igneous origin shows none. The colour of amethyst, rine, and smoky-quartz is due to the degree of dispersion of these lloidal particles, which may be changed by heating and by irradia-n. Amethyst which had been changed to orange-yellow by ating showed under the ultramicroscope fewer bright points than fore heating. L. J. S.

OFFMANN (Josef). *Amethyst- und Rauchquarzfärbungen.* Zeits. Anorg. Chem., 1931, vol. 196, pp. 225–246, 1 fig.

The colour of amethyst and smoky-quartz is attributed to radio-tive radiations, since β- and γ-rays restore the colour to decolorized ecimens. Since smoky-quartzes may or may not contain Fe and , this colour is attributed to the break-up of the polymeric quartz olecule by radiations. The pigment of amethyst is free from anganese, and is assigned to a combination of ferrous and ferric n; titanium and zirconium are also present. A quantity of mis-laneous data on thermoluminescence, fluorescence, and other ated properties of several minerals, both natural and after posure to radiations, is also given. M. H. H.

OFFMANN (Josef). *Über Mineralfärbungen.* Zeits. Anorg. Chem., 1934, vol. 219, pp. 197–202.

The colours of smoky-quartz, amethyst, citrine, and rock-salt are assed, and ascribed to the action of short-wave radiation (from dioactive elements) on impurities and inclusions. M. H. H.

YMAN (F.) & BRECH (F.). *X-irradiation of fused silica.* Nature, London, 1934, vol. 134, p. 180.

A surface of fused silica, exposed for eight hours to radiation from shearer X-ray tube with a silver target carrying 5 milliamperes 70,000 volts, changed to a very dark violet colour. The dis-oured glass reflected over 9% more ultra-violet light than the ar part. It is probable that the effect is due to a reduction of ca to silicon, the latter being an excellent reflector in the ultra-let. A specimen of quartz similarly treated showed only a faint ing and no measurable change in reflectivity. F. A. B.

LOßMACHER (K.) & MEYER (Irmg.). *Die farbgebende Substanz der natürlichen roten, blauen, braunen und violetten Spinelle von Ceylon.* Zeits. Krist., 1931, vol. 76, pp. 377–385. [Cf. M.A. **5**–123.]

nalyses of blue spinel showed FeO 2·62, 2·42 %, with no Co or Brown spinel gave Fe_2O_3 1·49, FeO 0·17 %, with no Ti, Mn.

One brown spinel which showed a red fluorescence in ultra-viol rays gave also Cr_2O_3 0·0014 %. Previous analyses of red spinel ha shown the presence of Cr_2O_3 up to 1·50 %. The red colour in spinel therefore due to chromium, the blue to FeO, and the brown to Fe_2O_3 and intermediate shades, reddish-brown and violet, to mixtures these. L. J. S.

Warner (T. W. *Jr.*). *Spectrographic analysis of tourmalines wi correlation of color and composition.* Amer. Min., 1935, vol. 2 pp. 531–536, 1 fig.

Spark spectra of differently coloured tourmalines from San Die Co., California, show Li, Na, Mg, Ca, Al, B, Mn, Si, V in all, and I Cu, Fe, Pb, Sn, Ti, Be in some. [In the table of results the colo of each sample is not stated.] The depth of colour in green tourm lines is proportional to the amount of iron present. In pink crysta (decolorized at 550° C.) iron is absent. Blue and bluish-green m be due to copper. L. J. S.

Klang (H.). *Beiträge zur Kenntnis der Absorption und Lichtbrechu von Aquamarin und einigen gelben und grünen Beryllen.* Neu Jahrb. Min., Abt. A, 1934, Beil.-Bd. 69, pp. 93–116, 1 pl., text-figs.

The refractive indices, density, and absorption of light we determined for several blue, green, and yellow beryls from vario localities. Green and yellow beryl changes to blue on heating, a the change in the absorption curves are noted. The colouring matt is probably ferrous and ferric iron. L. J. S.

Hoffman (J.). *Über die Konstitution der Ultramarine.* Zeits. Ano Chem., 1930, vol. 189, pp. 91–100.

The colour changes on exposure to radium radiation of a numb of ultramarines and substances capable of giving ultramarines (the widest sense) have been investigated. It is concluded that t sulphur in ultramarines is present in colloidal or true solution rath than combined. From the effect of radium radiation on sodal and from its chemical reactions, it follows that the chlorine attached to sodium. The ultramarine prepared from sodalite h a Si : Al ratio of 1·4 : 1. Hence it is concluded that sodalite based on a radicle $Na_4Al_4Si_6O_{24}$, which is combined with Na and to a less stable radicle $Na_6Al_6Si_6O_{24}$, and this in turn with NaCl,

still less stable combination, gives sodalite. These views are garded as agreeing with those of F. M. Jaeger. M. H. H.

EITMEIER (H.). *Die Barytvorkommen am Kitzbüheler Horn in Tirol.* Min. Petr. Mitt. (Tschermak), 1935, vol. 47, pp. 1–25, 1 fig.

White sparry baryte occurring as veins in dolomite has long been ined at this locality. The cleavage masses show gliding on (001). t one place the mineral is violet coloured, but this quickly fades exposure to light, and is again restored by exposure to radium. he dolomite-rock contains BaO 0·15 % (soluble in HCl and pre- mably as carbonate) near the veins and 0·08 % at some distance m them, but there is no evidence that the baryte was accumulated lateral secretion from the rock. L. J. S.

RINDLEY (G. W.), SPIERS (F. W.), & HOARE (F. E.). *X-ray and magnetic measurements of KCl powders in relation to lattice distortion and photo-chemical coloration.* Phil. Mag., 1935, ser. 7, vol. 20, pp. 1041–1054.

Mechanically ground specimens of potassium chloride show much eater photo-coloration than precipitated potassium chloride when adiated by X-rays. Grinding produces a larger proportion of cks and flaws within which are liberated metallic atoms. Measure- nts of the intensities of X-ray diffractions of high order show, wever, that grinding produces very little lattice distortion and ly a small decrease in diamagnetic susceptibility. F. A. B.

Growth and Corrosion of Crystals.

UBNIKOV (A. V.)] Шубников (А. В.). Как растут кристаллы. [*How crystals grow.*] Moscow & Leningrad (Acad. Sci.), 1935, 175 pp., 1 pl., 123 text-figs. Price 4 rub. 25 kop.

During recent years much work has been done on the growth of stals, many papers being by the author himself [M.A. **3**–329; **4**– 2; **5**–261, 348; **6**-111, 112], and this is the first book that has n written on the subject. After a brief account of crystals in neral, details are given of the various methods of growing large stals. The mechanism of growth is discussed, and different forms growth under varying influences are described. Unfortunately the ok is written in Russian, but some idea may be gained of the subject- tter from the many well-selected figures, the headings to sections the text, and the bibliographical references. A translation would welcome. L. J. S.

Spangenberg (K.). *Wachstum und Auflösung der Kristalle.* Hand wörterbuch der Naturwissenschaften, Jena, 2nd edition, 193 vol. 10, pp. 362–401, 33 figs.

A comprehensive review of recent work on the growth and solutio of crystals. L. J. S.

Russell (George A.). *Crystal growth and solution under local stres* Amer. Min., 1935, vol. 20, pp. 733–738, 3 figs.

Local stress produces local strains in glass and in crystals of halit as shown in polarized light. Pressure was applied with a rod on or face of a crystal of ammonium-alum immersed in a saturated solutio kept for many hours at a constant temperature and from which ar evaporation was prevented. Material was dissolved from this fa and an equivalent amount was deposited on other parts of the crysta This result is discussed in connexion with the growth of crystals metamorphic rocks. L. J. S.

Straumanis (M.). *Das Wachstum von Metallkristallen im Metalldamp I–III.* Zeits. Physikal. Chem., Abt. B, 1931, vol. 13, pp. 31 337, 14 figs.; 1932, vol. 19, pp. 63–75, 21 figs.; 1934, vol. 2 pp. 246–254, 7 figs.

Crystals of zinc, cadmium, and magnesium have been grown fro the vapour at various temperatures, and the influence of varied co ditions on the habit of growth and on the formation of nuclei studie The crystals of zinc and cadmium are normally thin hexagonal plat with stepped basal plane bounded by an oscillatory combination pyramids and basal plane; sometimes there is marked elongati along one a-axis. With magnesium, and under some conditions wi zinc and cadmium, simple bipyramidal crystals are formed. T forms developed were: Mg (0001), $(10\bar{1}0)$, $(10\bar{1}1)$, rarely $(10\bar{1}3$ Zn (0001), $(10\bar{1}0)$, $(10\bar{1}1)$, $(11\bar{2}0)$ on simple crystals, on the stepp crystals (0001), $(20\bar{2}5)$, $(10\bar{1}2)$, $(20\bar{2}3)$, rarely $(10\bar{1}0)$. Growth the stepped crystals occurs by addition of basal layers of regul thickness ($0{\cdot}8\mu$ approx. for Cd), which then spread rapidly sideway The form development of the single crystals is in accord with t theory of I. N. Stranski and R. Kaischew [M.A. **5**–110, 457]. T gliding laws for the magnesium crystals are given. The sublimati 'etch-figures' on zinc and cadmium were also studied. A cubic for of zinc does not exist. M. H. H.

TRAUMANIS (M.). *Das Wachstum von Metallkristallen im Metalldampf. IV.* Zeits. Physikal. Chem., 1935, Abt. B., vol. 30, pp. 132–138, 10 figs.

Tellurium crystals, grown from the vapour phase, show the rhombo-dral forms (100), (22$\bar{1}$), (2$\bar{1}\bar{1}$), (10$\bar{1}$), and ($\bar{1}$41), the last two being mparatively rare and usually small. Departures of this list from at expected on the Stranski-Kossel theory of crystal growth are scussed. M. H. H.

RDAGH (E. G. R.), RICHARDSON (R. E.), RICHARDSON (L. A.), & HUMBER (C. M.). *Observations on adsorption by precipitated barium sulphate.* Journ. Soc. Chem. Ind. London, 1934, vol. 53, pp. 1035–1041, 36 figs.

The effect of temperature, acidity, and an addition of NH_4Cl on e habit of $BaSO_4$ crystals obtained by precipitating $BaCl_2$ with SO_4 was studied. Increase of acidity (up to a limit) and of tem-rature favour the production of perfect single crystals, as does the sence of NH_4Cl. Conditions for obtaining good (though minute) stals were worked out. The adsorption of croceine scarlet 3BX the precipitate was studied; the dye is absorbed locally by the wing crystals, and some habit variation results. Imperfect crystals aggregates were always uniformly stained. When the method precipitation is reversed ($BaCl_2$ added to K_2SO_4), the dye adsorp-n is greatly reduced, and is not localized. It is suggested that the lusion of dye within the crystal only occurs when there is some ange in the manner of crystal growth'. If the conditions during wth could be maintained absolutely constant, there would probably no inclusion of dye. M. H. H.

RANSKI (I. N.) & KAISCHEW (R.). *Kristallwachstum und Kristall-keimbildung.* Physikal. Zeits., 1935, vol. 36, pp. 393–403, 7 figs.

A theoretical study of the formation and growth of crystal nuclei, part a summary of previous papers. It is shown that a crystal ist grow by the addition of monomolecular layers on the faces, ich grow outwards from the centre of the face [cf. M.A. **6**-65]. r any given degree of supersaturation there is a certain crystal e (the 'nuclear' size) for which the probability of further growth l of dissolution are equal, smaller crystals being more likely to solve than to grow. Further, in the formation of a monomolecular

layer on the crystal face, there is a certain size of layer (the 'tw dimensional nucleus') below which the layer is more likely to disso up again than to grow; in the case of a homopolar cubic crystal, edge of the 'two-dimensional nucleus' is half that of the thr dimensional nucleus for the same degree of supersaturation. Th at low degrees of supersaturation further growth on crystals alrea present will tend greatly to outweigh the formation of new cryst whereas at high degrees of supersaturation both processes will oc together. The variation of the nucleus size with the degree of sup saturation is considered; at first relatively large, the size decrea rapidly with increasing supersaturation, accounting for the me stable range of supersaturated solutions. The variation in the r of crystal growth with degree of supersaturation is also consider [Cf. M.A. **5**–110, 457]. M. H. H

Hughes (Edwin Burnhope). *An analytical study of Liesegang rin* Biochem. Journ., 1934, vol. 28, pp. 1086–1106, 1 pl., 18 te figs.

Banded precipitates were made from silver nitrate and potassi chromate in gelatine, and the gel sectioned and analyses made of bands of precipitate, the clear areas, and the region immediately p ceding the leading precipitate. The results are in agreement w the supersaturation theory. M. H. H

Buckley (H. E.). *Some new features in habit-modification shown $KClO_4$ crystals.* Zeits. Krist., 1935, vol. 91, pp. 375–4 12 figs.

Potassium perchlorate crystals grown from pure water are tab on (001) with (110), (102), and rarely (011). Inorganic ions ad to the water affect the habit in much the same way as they do $KMnO_4$. Similar observations were made on change of habit w complex dyes were present, to which there are no parallels in the c of the permanganate. H. H

Papapetrou (A.). *Untersuchungen über dendritisches Wachstum Kristallen.* Zeits. Krist., 1935, vol. 92, pp. 89–130, 57 figs.

A mathematical theory is developed of the formation of dendr growths of crystals. It is illustrated by observations of crys formed on a microscope slide, the substances employed being NH NH_4Br, $Pb(NO_3)_2$, NaCl, NaBr, KBr, NH_4NO_3, and $NaClO_3$. H. H

YULAI (Z.). *Beobachtungen über das Kristallwachstum an Alkalihalogeniden.* Zeits. Krist., 1935, vol. 91, pp. 142–153, 13 figs.

Pictures are given of skeleton growths of sodium and potassium loride crystals obtained by rapid evaporation of the solvent or by blimation or cooling of the molten solid. H. H.

NGEMACH (H.). *Sur la syntaxie et la polytypie.* Zeits. Krist., 1935, vol. 91, pp. 1–22.

Syntaxy is the simultaneous growth under similar physical conditions of two or more substances with the same chemical composition t different (though usually somewhat similar) crystalline forms and ructures. Examples are coquimbite and paracoquimbite [M.A. **5**–0, **6**–149], parisite and synchysite, and also the three varieties of rborundum. H. H.

ORNFELD (M.). *Anisotropie der Wachstumsgeschwindigkeit neuer Körner bei der Rekristallisation.* Physikal. Zeits. Sowjetunion, Charkow, 1934, vol. 6, pp. 170–174, 4 figs.

The etching of samples of drawn aluminium wire heated for long riods just above the temperature of recrystallization reveals that e speed of growth of the new crystals along the axis of the wire is ater than in other directions. The anisotropy of the speed of stal growth decreases with the increase in temperature.

F. A. B.

VÁK (Jiří). *Ein Beitrag zur Symmetrieverminderung der Korrosionfiguren durch optisch aktive Zusätze.* Zeits. Krist., 1935, vol. 90, pp. 385–391, 10 figs.

Addition of an increasing percentage of optically active malic acid the acetic acid, which was being used to etch calcite, causes an creasing lack of symmetry in the etched figures and in the reflections hich they give in the goniometer. H. H.

KEEHAN (L. W.) & HOGE (Harold J.). *Etch planes of tin.* Zeits. Krist., 1935, vol. 92, pp. 476–478.

Bars of tin can be etched with hydrochloric acid so that the forms 01), (301), (100), (110), (112) are developed clearly enough to enable e crystallographic orientation of the tin to be measured by the niometer. H. H.

Pearce (D. W.), Quirke (T. T.), & Hopkins (B. S.). *Chemical stabili of the terminal faces of acicular crystals.* Amer. Journ. Sci., 193 ser. 5, vol. 30, pp. 116–120, 5 figs.

In the electrolytic reduction of ytterbium chloride ($YbCl_3$) in th presence of H_2SO_4 the precipitated $YbSO_4$ has the form of radiatir tufts of acicular crystals; but with slower precipitation, with a weak current and in the presence of more acid, a granular precipitate [spherulites] was obtained. The granular form is more resistant acids than the acicular tufts; and it is believed that this is due to th lower solubility of the ends of the crystals [but it evidently depen on the total surface exposed to the solvent]. It is argued [incorrectl that acicular crystals of various substances are of slower growth tha crystals of other habits. L. J. S.

Himmel (Hans) & Kleber (Willi). *Ätzversuche an Konkavkörpe I. Teil. Versuche an Hohlhalbkugeln von Fluorit (auf p).* Neu Jahrb. Min., Abt. A, 1934, Beil.-Bd. 69, pp. 42–59, 6 pl 7 text-figs.

A concave spherical surface, 7 mm. diam., was bored and polish in a cleavage surface of fluorite, and subjected in constant motion the action of 10 % HCl, H_2SO_4, or HNO_3 at 30° C. for several hou The etch pits (rather than hills) so produced are described and figur and the light-figures plotted. [Cf. M.A. **5**–268.] L. J. S.

Royer (Louis). *Nouvelles observations sur la décroissance d'un cris de calcite dans un milieu isotrope actif; remarque sur les figu de corrosion dans la dolomie.* Compt. Rend. Acad. Sci. Pa 1936, vol. 202, pp. 429–431.

Solutions of optically active acids produce no dissymmetric et figures on (111), but do so on (110), $(2\bar{1}\bar{1})$, and $(10\bar{1})$ of calcite; th of inactive acids do so only on $(10\bar{1})$. The faces of calcite which sensitive to the activity of the etching solution are therefore only th which have as their sole element of symmetry one perpendicu plane. On dolomite active and inactive acids alike produce d symmetric figures on (100), but neither does so on (111). [M.A. 120.] C. A. S.

Frondel (Clifford). *Vectorial chemical alteration of crystals.* Am Min., 1935, vol. 20, pp. 852–862, 1 fig.

Examples are quoted from the literature and from museum spe mens of crystals (of pyrite, enargite, stibnite, tourmaline, &c.) th

ow the effect of chemical action on certain faces only, these faces ing coated with alteration products. The edges of crystals, perfections on faces, twin lamellae, and zonal structures may also esent an opportunity for differential chemical action. L. J. S.

ONDEL (Clifford). *Oriented intergrowth and overgrowth in relation to the modification of crystal habit by adsorption.* Amer. Journ. Sci., 1935, ser. 5, vol. 30, pp. 51–56. [Cf. M.A. **6**–110.]

The factor determining the relative orientation of the crystals in ented overgrowths, the faces coated where encrustation is selective, segregation plane in perthitic and Widmanstätten segregates, and relative orientation of the original and new phase in polymorphic nsformations, is believed to be a similarity in lattice structure the planes of the two solids which are in contact. It is suggested at the modification of crystal habit due to foreign substances pre- nt in solution is due to essentially similar causes, the foreign stances forming an adsorbed layer structurally similar to the face which it is deposited and which it favours the development of. In ne cases the effective adsorbed substance may be an unstable plex of the foreign substance and the substance of the crystal, some other non-isolable unstable compound. M. H. H.

Crystal-optics.

YRHOFER (A.). *Über Immersionsflüssigkeiten zur Bestimmung des Brechungsvermögens fester Körper nach dem Einbettungsverfahren.* Mikrochemie, 1931, vol. 9, pp. 52–71.

The behaviour of a number of immersion liquids is discussed in at detail. The stability of some mixtures and their departure m the additive 'mixture law' are considered, and the temperature fficients of the refractive indices of several of the most used liquids given. M. H. H.

THIEU (J. P.). *Étude de la dispersion de biréfringence d'un échantillon de muscovite.* Bull. Soc. Franç. Min., 1934, vol. 57, pp. 233–240, 2 figs.

A method is described of measuring the birefringence of colourless scovite cleavage plates for visible and ultra-violet light. The efringence is practically independent of wave-length from 2605 to 0 Å. F. A. B.

Sundararajan (K. S.). *On the measurement of the thickness of t transparent crystalline plates.* Phil. Mag., 1935, ser. 7, vol. pp. 1076–1079, 1 pl.

A new method is described for the measurement of the thickness thin plane-parallel crystal plates, suitable for plates of area down about $1 \times \frac{1}{2}$ mm. The method depends on the development of Tal bands and Edser-Butler fringes in a suitable spectrum by the introd tion of the plate in the optical path, and has a much greater accur than any other method available for very thin plates, estimated 0·2 % for a thickness of 5 μ. M. H. H

Bruhat (Georges) & Weil (Louis). *Mesure de la rotation du plan polarisation dans la réfraction cristalline oblique.* Compt. Re Acad. Sci. Paris, 1935, vol. 200, pp. 2192–2194.

Bruhat (G.) & Weil (L.). *Rotation du plan de polarisation réfraction cristalline oblique.* Bull. Soc. Franç. Min., 19 vol. 58, pp. 294–313, 6 figs.

Formulae are derived for calculating the rotation of the plan polarization of light refracted obliquely by a crystal plate. Exp mental data for plates of calcite and quartz show that for angle incidence 9° and 15° the rotations vary from 0·10° to 0·25°, in c agreement with calculated values. It is concluded that the effec negligible in polarimetry. F. A. I

Bruhat (Georges) & Weil (Louis). *Construction et emploi quart d'onde composé en quartz.* Compt. Rend. Acad. Sci. P. 1935, vol. 201, pp. 719–721.

The compensator (for λ 3000–2500 Å.) consists of two plate quartz (left and right-handed) cut parallel to the axis and cros of thicknesses 107·7 and 101·3 μ. The construction and use described. C. A.

Bruhat (Georges) & Weil (Louis). *Le pouvoir rotatoire du qu pour les rayons perpendiculaires à l'axe optique et sa dispe entre 2537 et 5780 angströms.* Compt. Rend. Acad. Sci. P 1935, vol. 201, pp. 887–889.

Repetition of the authors' previous experiments [M.A. **6**–70] their extension to the region λ 3021–2537 Å. by means of their qu compensator (previous abstract) give nearly the same results, show that at least for this interval the rotatory dispersion of qu is the same for rays parallel and perpendicular to the axis.

C. A.

BRYANT (W. M. D.). *Crossed axial plane dispersion in two organic compounds. A peculiar extinction phenomenon.* Amer. Min., 1935, vol. 20, pp. 281–291, 2 figs.

Optic axial angle measurements at different wave-lengths and temperatures are given for triphenylbismuthine dichloride [Min. Mag., **20**–123; M.A. **5**–128] and for the monoclinic modification of ethyl triphenylpyrrolone, and the points of uniaxiality are fixed. The green colour shown by triphenylbismuthine dichloride in the position of extinction is not due to rotatory polarization, but to the fact that the crystal is uniaxial for this colour. L. J. S.

DRUMMOND (D. G.). *The infra-red absorption spectra of quartz and fused silica from 1 to 7·5 μ. I—Experimental method.* Proc. Roy. Soc. London, Ser. A, 1936, vol. 153, pp. 318–327.

—— *II—Experimental results.* Ibid., pp. 328–339, 3 pls., 1 text-fig.

Absorption curves are given for different thicknesses of quartz (ordinary and extraordinary rays) and of silica-glass in the near infra-red. L. J. S.

ATOSSI (Frank) & BRIX (Helmut). *Die Temperaturabhängigkeit der Ultrarotabsorption von Kristallen. I. Beobachtungen an Flußspat und Kalkspat.* Zeits. Physik, 1934, vol. 92, pp. 303–311, 6 figs.

ATOSSI (Frank) & KINDLER (Heinrich). —— *II. Beobachtungen an Sulfaten und Glimmern.* Ibid., pp. 312–336, 22 figs.

The absorption spectra of specimens of fluorite, calcite, anhydrite, celestine, baryte, muscovite, and clinochlore were measured for wave-lengths in the far infra-red from 20,000 to 200,000 Å. and for various temperatures between −125° C. and 300° C. Isochromatic curves reveal a change-point of muscovite and clinochlore at 100° C. A detailed discussion is given of the experimental data. F. A. B.

LOCHINZEW (D.). *Zur Theorie der Lichtabsorption in heteropolaren Kristallen.* Physikal. Zeits. Sowjetunion, Charkow, 1935, vol. 7, pp. 639–651.

A quantum theory of light absorption in ionic substances is developed and shown to agree with the experimental result that the widths of absorption bands are independent of temperature. F. A. B.

MUELLER (Hans). *Theory of the photoelastic effect of cubic crystals.* Physical Review, 1935, vol. 47, pp. 947–957, 3 figs.

A crystal of a cubic substance subjected to a pressure normal to a cube face shows double refraction and behaves like a tetragonal

substance. The Ewald-Born theory of double refraction is extended b assuming that elastic deformations produce optical anisotropy of t atoms to explain satisfactorily the change of refractive index wi density and the photoelastic properties of crystals of sodium chlorid potassium chloride, fluorite, and diamond. F. A. B.

Gaubert (P.). *Anisotropie permanente des verres à vitre.* Bull. So Franç. Min., 1935, vol. 58, pp. 314–323, 1 pl., 1 text-fig.

The study of liquid crystals has led to an examination of the bi fringence of the glass slide and cover glasses commonly employed microscopy. The thinner glass plates in general show the great birefringence. Six superposed cover glasses yield a negative uniax figure. A cover glass or slide examined on edge between cross nicols reveals a system of bands similar to the polysynthetic twinni of felspars. The bands are of variable width and are optically po tive and negative alternately. Glass tubes show similar effe (2E 12°), the negative acute bisectrix lying perpendicular to the a of the tube. Silica-glass tubes and the silica-glass of siliceous bri are also weakly birefringent. F. A. B

Mallemann (René de) & Suhner (François). *Propriétés optiq superficielles du spath.* Compt. Rend. Acad. Sci. Paris, 19 vol. 201, pp. 1344–1346.

Observations of rectilinearly polarized monochromatic light flected from polished surfaces of calcite cut in definite directi imply the existence on such surfaces of an isotropic layer. Its p cise character seems to depend on the method of polishing. Th are also indications that a similar surface exists to at least so extent on a natural cleavage surface. C. A. S

Orcel (Jean) & Fastré (Pierre). *Courbes de dispersion de quelq étalons de pouvoirs réflecteurs utilisables dans l'étude microscopi des minerais métalliques.* Compt. Rend. Acad. Sci. Paris, 19 vol. 200, pp. 1485–1488, 1 fig.

Determined by means of an improved form (described) of Orc photoelectric method for light of wave-length 4000–6500 Å. reflection powers of tetrahedrite and diamond show but slight persion, of blende somewhat greater, and of galena and silicon s greater, but in all these cases the power decreases as wave-len increases; that of pyrite is abnormal, being greater still, and hav a maximum for 5800 Å. [M.A. **4**–444; **5**–205]. C. A. S

RCEL (J.). *L'éclat des minéraux et la mesure de leurs pouvoirs réflecteurs au moyen du microscope photoélectrique.* Arch. Mus. Nat. Hist. Paris, 1935, ser. 6, vol. 12, pp. 171–189, 1 pl., 6 text-figs.

A collected account of earlier papers [M.A. **3**–400; **4**–229, 444; -206, 411] with a table of the reflective powers of a series of opaque inerals. L. J. S.

ENDL (M.). *Vorläufige Mitteilungen über die volumprozentuelle Mengenbestimmung von Mineralkomponenten mittels Messung des vom Anschliff reflektierten Lichtes.* M. kir. József Nádor műszaki és gazdaságtudományi egyetem, Bánya-kohó-és erdőmérnöki kar—Sopron, A bánya-és kohómérnöki osztály Közleményei [Royal Hungarian Palatin-Joseph university of technical and economical sciences, Department of Mining, Metallurgy, and Forestry of Sopron, Publications of the Department of Mining and Metallurgy], 1934, vol. 6, pp. 285–288 (with French summary).

The variation of the intensity of the light reflected by polished tions (of coals and ores) moved under the objective of an oreicroscope can be registered automatically by a photocell and ivanometer. The curves obtained on sensitive paper permit the iculation of the volume percentage of the components, using the nciples of the method of Rosiwal. V. Z.

JSNETZOW (W. D.) & KOTLER (Wera N.). *Zur Frage der Kristallumineszenz von NaCl.* Physikal. Zeits. Sowjetunion, Charkow, 1934, vol. 5, pp. 40–56, 4 figs.

Experiments are described showing that the emission of light ring the crystallization of sodium chloride from a saturated aqueous lution of the salt to which hydrochloric acid has been added is not e to recombination of the ions, but is closely connected with the enomena of triboluminescence. The intensity and time duration the emission of light vary with the condition of mixing and crease with the degree of supersaturation of the sodium chloride lution. F. A. B.

ORNTON (William M.) & LEWIS (Margaret N.). *Photographie de minéraux fluorescents.* Bull. Soc. Franç. Min., 1934, vol. 57, pp. 268–269, 3 pls.

Photographs are reproduced of specimens of autunite and willemite uminated by ordinary light and ultra-violet light. F. A. B.

Quinn (Alonzo). *A petrographic use of fluorescence.* Amer. Min. 1935, vol. 20, pp. 466-468, 2 figs.

A hand-specimen of nepheline-syenite from Red Hill, New Hampshire, was photographed in white light and in ultra-violet light. The latter shows the distribution of the sodalite, which fluoresces with an orange-red colour. L. J. S.

Haberlandt (Herbert). *Lumineszenzuntersuchungen an Fluoriten und anderen Mineralien.* Sitz.-ber. Akad. Wiss. Wien, Math.-naturwiss. Kl. Abt. II a, 1934, vol. 143, pp. 591–596. [Cf. M.A. **5**–506, **6**–72.]

The fluorescent spectra of further fluorites were examined for rare earths. Some show uranium; and the uranium band is also shown by some scapolite, sodalite, haüyne, and hyalite. L. J. S.

Haberlandt (Herbert), Karlik (Berta), & Przibram (Karl). *Zur Fluoreszenz des Fluorits, III. Das Linienfluoreszenzspektrum.* Sitz.-ber. Akad. Wiss. Wein, Math.-naturwiss. Kl., Abt. II a, 1935, vol. 144, pp. 77–83.

—— —— —— —— *IV. Über einen Urannachweis in Fluoriten und über die Tieftemperaturfluoreszenz.* Ibid., pp. 135–140, 1 fig.

Przibram (Karl). —— *V. Über die Fluoreszenz des Europiumdichlorids und über Alkalihalogenid-Europiumphosphore.* Ibid., pp. 141–149, 4 figs. [Cf. M.A. **5**–506.]

The spectra of the fluorescence of fluorite from various localities show the blue band of europium. Some show the green uranium band, and some the yellow-green of the low-temperature fluorescence of ytterbium. L. J. S.

Yoshimura (Jun). *On the cathodo-luminescence spectra of fluorites and calcites and certain synthetized phosphors containing samarium.* Sci. Papers Inst. Physical & Chem. Research, Tokyo, 1934, vol. 23, no. 487, pp. 224–247, 2 pls., 5 figs.

The cathodo-luminescence spectra of fluorites show the line-like bands due to Sm, Eu, Dy, Tb, and sometimes, especially in green fluorite from Japan, Er, Pr, Nd, Gd. Similar results are obtained with artificial CaF_2, SrF_2, and BaF_2 containing samarium fluoride (0·1 %): with SrF_2 and BaF_2 there is a slight progressive shift of the bands. Calcite giving an orange cathodo-luminescence shows a broad band due to manganese. Bands of the rare-earths are masked by the manganese band; but they are shown by the CaO obtained by ignitin

ose calcites which are also thermo-luminescent. Similar results re obtained with $CaCO_3$, $SrCO_3$, and $BaCO_3$ activated with manese and samarium carbonate. L. J. S.

IORI (Satoyasu). *The solarization of luminiferous calcite.* Sci. Papers Inst. Physical & Chem. Research, Tokyo, 1933, vol. 21, no. 439, pp. 220–231, 9 figs. [Cf. M.A. **5**–125, 345.]

Calcite from Nabeto, Japan, exposed to ultra-violet rays, shows a adual increase in the intensity of the photo-luminescence, reaching maximum in about 40 minutes; after which there is a decline. second much weaker maximum is attained after about 33 hours. theoretical explanation is given of this periodical solarization. L. J. S.

ASE (Eiichi). *Über das Fluoreszenzspektrum des Apatites im ultravioletten Lichte.* Sci. Papers Inst. Physical & Chem. Research, Tokyo, 1935, vol. 27, no. 567, pp. 1–9, 8 pls., 4 text-figs.

Photometric records of the fluorescence spectra of specimens of atite from various localities reveal two main types. Tabular atite from metalliferous veins gives strong broad fluorescence nds, whilst apatite of prismatic habit from basic igneous rocks es only weak narrow bands. F. A. B.

Physical Properties.

DGWAY (Raymond R.), BALLARD (Archibald H.), & BAILEY (Bruce L.). *Hardness values for electrochemical products.* Trans. Electrochem. Soc. New York, 1933, vol. 63, pp. 369–393, 8 figs.

Hardness tests by three methods were made on the specially hard ducts from the electric furnace. (1) Scratching test with constant ssure on a sclerometer; the scratching point being a polished cubic ner of diamond, and the surface to be scratched was polished. Impact abrasion test with grains in an air blast through a fine zzle, which is continued until a pit of a certain depth is eroded. A v apparatus for this test is described. (3) Rockwell metal ball imssion test. The following extension of Mohs's scale of hardness uggested, 6 orthoclase, 7 silica-glass, 8 quartz, 9 topaz, 10 garnet, fused zirconia, 12 sapphire or fused alumina, 13 silicon carbide, boron carbide, 15 diamond. On this scale stellite is 8, tantalum bide 11, and tungsten carbide 12. L. J. S.

Tertsch (Hermann). *Gerichtete Schleifhärtenversuche am Dolomit.* Anzeiger Akad. Wiss. Wien, Math.-naturwiss. Kl., 1935, vol. 72, pp. 205–207.

Tertsch (H.). *Schleifhärtenversuche am Dolomit.* Zeits. Krist., 1935, vol. 92, pp. 39–48, 2 figs.

The apparatus devised to test the hardness of calcite in different directions [M.A. **6**–74] was used to measure the hardness of dolomite. The curve on the cleavage face is quite unsymmetrical and has a minimum vector in the direction of the polar corner. H. H.

Shappell (M. D.). *Cleavage of ionic minerals.* Amer. Min., 1936, vol. 21, pp. 75–102, 2 figs.

A review is given of the literature on the various views that have been held as to the relation between cleavage and the structure of crystals. A distinction is made between the work of separation or 'cleavability' and the character of the fractured surfaces. From the electrical theory of matter a formula is deduced for the cleavability, and values are calculated for a number of ionic minerals. The results are in general agreement with the observed degrees of ease and perfection of cleavage, but with some wide differences.

L. J. S.

Andrade (E. N. da C.) & Hutchings (P. J.). *The mechanical behaviour of single crystals of mercury.* Proc. Roy. Soc. London, Ser. *A*, 1935, vol. 148, pp. 120–146, 3 pls., 7 text-figs.

Single crystals were grown by slowly lowering a capillary tube filled with mercury into a freezing bath. When stretched they glide on the rhombohedral faces (100) in the direction of the short diagonal with twinning on (110). L. J. S.

Komar (A.). *Geometrie der plastischen Deformation von Steinsalzkristallen.* Zeits. Krist., 1935, vol. 90, pp. 467–469, 6 figs.

Laue diagrams are given to determine the structure of compressed rock-salt. H. H.

Bechterew (P.). *Die bestimmenden Elastizitäts- und Deformationskoeffizienten der Kristalle mit Anwendung für die Isotropie.* Zeit. Krist., 1935, vol. 92, pp. 1–29, 3 figs.

A theoretical study, introducing a new classification for crystalline substances according to the value of Poissan's coefficient ($\mu = \frac{1}{2}$, $\mu = \frac{1}{4}$, $\mu = \frac{1}{3}$, and $\mu = -1$). The elastic constants of many metal-

oys, artificial salts, and minerals are tabulated illustrating the thor's terminology. F. A. B.

KSTEIN (H.). *Zur Temperaturabhängigkeit der Plastizität.* Zeits. Krist., 1935, vol. 92, pp. 253–274, 16 figs.

The plasticity of wolframite, rock-salt, and bakelite was measured temperatures varying from −185° to 300° C. The first two bstances behaved in a manner similar to that of other crystalline terials, indicating that the phenomena are mainly athermal; but kelite shows abrupt changes in behaviour between 16° and 60° C. agreement with the thermal theory of plasticity. H. H.

ALMERS (Bruce). *The twinning of single crystals of tin.* Proc. Physical Soc. London, 1935, vol. 47, pp. 733–746, 1 pl., 4 text-figs.

Small specially prepared cylindrical blocks of tin were etched, and free from crystal boundaries examined with a beam of slightly vergent light. Light was reflected in a number of definite direc-ns inclined to the geometrical normals of the cylinder, i.e. from stal faces, and the angular distribution of reflection spots enabled position of the crystal axes to be simply determined. Twinning ut the plane (301) may be readily induced by shock, and a ballistic dulum method was used to apply known impulsive forces to the cimens. It is found that the loss of kinetic energy in an impact ich results in twinning is proportional to the volume twinned reby and is equivalent to 8×10^5 ergs. per c.c. twinned. This rgy loss if completely converted into heat would represent a rise mperature of 0·05° C. in the twin-crystal. The process of twinning elation to the crystal-structure of tin is also discussed. F. A. B.

GOBERIDZE (D. B.) & ANANIASCHWILI (E. G.). *Über mechanische Zwillingsbildung beim Kalkspat. I.* Physikal. Zeits. Sowjetunion, Charkow, 1935, vol. 7, pp. 547–552, 5 pls.

An optical and X-ray study of mechanically twinned calcite shows t the angle of rotation about the twin-axis is constant. The raction spots on Laue photographs reveal no asterism; lattice tortion along the twin-plane (110) is, however, detected, and a n layer of fine-grained calcite separating the two portions of vin can usually be seen with the naked eye. Twinned and un-nned calcite are equally soluble in weak hydrochloric acid.

F. A. B.

Saïni (Hugo). *Note sur la dilatation thermique de la calcite.* Compt. Rend. Soc. Physique et Hist. Nat. Genève, 1935, vol. 52 pp. 108–109.

The thermal expansion of calcite from Big Timber, Montana determined by the X-ray method at 25–100° C. gave parallel th axis $2{\cdot}7 \times 10^{-5}$, and perpendicular the axis $-0{\cdot}325 \times 10^{-5}$.

L. J. S.

Kôzu (Shukusuké) & Kani (Kô-ichi). *Thermal expansion of aragonit and its atomic displacements by transformation into calcite betwee 450° C. and 490° C. in air.* Proc. Imp. Acad. Tokyo, 1934 vol. 10, pp. 222–225, 271–273, 8 figs.

A rectangular block cut from a crystal of aragonite from Matsu shiro, prov. Iwami, Japan (α 1·5300, β 1·6820, γ 1·6845, 2V 18° 14′) showed a gradual linear expansion along the axes up to 450° C. amounting at this temperature to *a* 0·38, *b* 0·86, *c* 1·66 %. Betwee 450° and 490° C. there was a rapid increase in volume of 20·65 % corresponding to the change into calcite. After that there wa another gradual increase. Similar results were obtained wit aragonite from Bilin, Bohemia. The shift of CO_3 groups in th structure models explains the change from aragonite to calcite, th *c*-axes remaining coincident in the two crystals. L. J. S.

Kossolapow (G. F.) & Trapesnikow (A. K.). *Röntgenographisch Untersuchung der thermischen Ausdehnung des Cadmiums.* Zeits Krist., 1935, vol. 91, pp. 410–423, 4 figs.

The lattice constants *a* and *c* of cadmium were measured fo temperatures between 26° and 189° C. The ratio *c*/*a* increases wit increasing temperature. H. H.

Rosenholtz (Joseph L.) & Smith (Dudley T.). *The dielectric constar of mineral powders.* Amer. Min., 1936, vol. 21, pp. 115–120 Bull. Rensselaer Polytech. Inst., Troy, N.Y., 1936, no. 52, 10 pp

The method used is that of H. S. Hatfield and B. W. Holma (Bull. Inst. Mining & Metall., 1924, nos. 233 and 234) for the separa tion of minerals. An alternating current of 60 cycles and 220 volt with 2000 ohm resistance is carried to two needle points 1 mm. apar Mineral grains with a dielectric constant ϵ higher than that of th liquid in which they are immersed are attracted to the needles, whils those with lower ϵ are repelled. The liquids used were mixtures c carbon tetrachloride (ϵ 2·24 at 20° C.) and methyl alcohol (ϵ 33·7 a 20° C.), and water (ϵ 81). Determinations were made on powde

50–300 mesh) of 160 different minerals, and the average values of t 20° C. range from 3·62 for sulphur to over 81 for metals, graphite, any sulphides and arsenides, and some oxides. A few other values : diamond 4·58, calcite 6·36, quartz 6·53, fluorite 7·11, cuprite ·20, cassiterite 27·75. The values are not definite enough for rposes of identification, but the differences are sufficient to effect paration. L. J. S.

oß (B.). *Zur elektrischen Leitfähigkeit der Zeolithe.* Zeits. Krist., 1935, vol. 92, pp. 284–292, 8 figs.

When a direct current is passed through a zeolite Ohm's law only lds for a short period. After a time the strength of the current reases and hysteresis is observed. A similar result occurs with an ernating current. The author discusses the question whether the parture from Ohm's law may be due to temperature changes.

H. H.

ENKEL (J.) & KONTOROWA (T.). *The elementary theory of galvanomagnetic phenomena in crystals.* Physikal. Zeits. Sowjetunion, Charkow, 1935, vol. 7, pp. 452–463, 1 fig.

By taking into account the electrostatic field due to the crystal tice, Sommerfeld's theory of metals is extended to account for the malous Hall effect and the actual magnitudes of the resistance in nsverse magnetic fields of cubic divalent metals. F. A. B.

SANDT (C.). *Elektrizitätsleitung und Diffusion in nichtmetallischen Festkörpern.* Zeits. Elektrochem., 1933, vol. 39, pp. 500–506, 2 figs.

The electrolytic conductivity of ionic crystals is discussed and perimental results given. The relation of diffusion and conductivity discussed. Numerous references to the literature are given.

M. H. H.

ALILEEW (P. A.). *Anderung des Widerstandes von Magnetit im Magnetfelde bei tiefer Temperatur.* Physikal. Zeits. Sowjetunion, Charkow, 1935, vol. 7, pp. 108–114, 4 figs.

The decrease in electrical resistance of three specimens of native gnetite when magnetized was measured between 80° and 120° K. e maximum decrease in resistance of 8–10 % occurs when magne- e is cooled to 111° K. = − 162° C. in a field of 9000 gauss. This nperature corresponds to a change in structure related to the Curie nt change for ferromagnetic phenomena. F. A. B.

Osterberg (H.) & Cookson (J. W.). *Some piezoelectric and elast properties of β-quartz.* Journ. Franklin Inst. Philadelphia, Pa 1935, vol. 220, pp. 361–371, 3 figs.

β-Quartz (hexagonal holoaxial) above the transition point 573·5 575° C. shows a greater piezoelectric effect than α-quartz. At 847° (the material is no longer piezoelectric, indicating a transition t perhaps γ-quartz (or tridymite). L. J. S.

Greenwood (Gilbert). *Experiments on piezoelectricity.* Zeits. Krist 1935, vol. 91, pp. 235–242, 1 fig.

Several substances were tested for piezoelectricity with an apparatu of high sensitiveness. The phenomenon was observed in scapolit 1-chlor-2.4.dinitrobenzene, santonine, brucine, *m*-chloracetanilid and methyl urea. Potassium bichromate, topaz, wulfenite, silv nitrate, &c., gave negative results. H. H.

Joffé (Anne) & Joffé (A. F.). *Photoelectromotive forces in cupri crystals.* Physikal. Zeits. Sowjetunion, Charkow, 1935, vol. pp. 343–365, 14 figs.

Further experiments are described upon the photoelectromoti forces in crystals of cuprite from the Ural Mts. The diffusion formu of Dember and Teichman is modified by considering the transfer photoelectrons, leading to a relation between the photoelectromoti force and temperature in agreement with experimental result [M.A. **5**–212, 352.] F. A. B.

Koenigsberger (J. G.). *Magnetische Eigenschaften der ferroma netischen Mineralien in den Gesteinen.* Beitr. Angew. Geophysi 1934, vol. 4, pp. 385–394.

—— *Die Abhängigkeit der natürlichen remanenten Magnetisierung l Eruptivgesteinen von deren Alter und Zusammensetzung.* Ibi 1935, vol. 5, pp. 193–246, 13 figs.

—— *Residual magnetism and the measurement of geologic tin* Report XVI Internat. Geol. Congress, Washington, 1933. Pr print, 1935, 7 pp.

Magnetization is induced in the ferromagnetic minerals during t cooling of igneous rocks in the earth's field, and the residual magnetis is generally greater in younger than in older rocks. Measuremen were made on magnetite, pyrrhotine, haematite, ilmenite, and vario rocks. From the intensity and direction of the residual magnetis in rocks of known age and known orientation in situ, it may possible to reconstruct the changes in the earth's field during pa

ological periods; and from the data so obtained to determine the e of other rocks. L. J. S.

RISHMAN (K. S.) & BANERJEE (S.). *The magnetic anisotropy and crystal-structure of 1.2; 5.6-dibenzanthracene.* Zeits. Krist., 1935, vol. 91, pp. 173–180, 1 fig.

— —— *An orthorhombic crystalline modification of 1.2; 5.6-dibenzanthracene.* Ibid., pp. 170–172.

Measurements were made of the magnetic anisotropy of both the thorhombic and the monoclinic varieties of the dibenzanthracene $_{22}H_{14}$). The orthorhombic crystals have $a : b : c = 0{\cdot}755 : 1 : 0{\cdot}546$, th a density 1·282 and melting-point 260° C. H. H.

Miscellaneous.

UPLETSKY (B. M.)] KUPLETSKIJ (B.) (KUPLETSKY (B.)). *Ein Mineral der Astrophyllitgruppe vom Berge Urma-Waraka im zentralen Gebiet der Halbinsel Kola.* (Куплетский (Б. М.). Минерал астрофиллитовой группы с горы Урма-Варака в центральной части Кольского полуострова.) Докл. Акад. Наук СССР (Compt. Rend. Acad. Sci. URSS), 1929, pp. 343–347.

A mineral of the astrophyllite group was found in quartz and pegmatite veins associated with the alkali-granite of central Kola (150 km. st of Imandra station on the Murmansk railway). The mineral curs as stellate groups of elongated crystals and also in intergrowth th quartz and arvfedsonite. The optical properties are α 1·740, 1·746, γ 1·765, 2V 80°, positive, axial plane (010); pleochroism, ne or weak. Analyses by D. Tischenko of pure material gave SiO_2 ·87, TiO_2 10·36, ZrO_2 trace, Al_2O_3 trace, Fe_2O_3 34·25, FeO n.d., nO 1·38, MgO trace, CaO 2·12, Na_2O 2·16, K_2O 3·50, H_2O- 1·21, n. loss 2·36, total 102·21; sp. gr. 3·240. The high total is explained the result of the determination of iron as Fe_2O_3. Recalculation ves Fe_2O_3 11·20 and FeO 20·74, making the total 99·86. The calcued formula is $(Na_2,K_2)O.Fe_2O_3.2(Si,Ti)O_2.5(FeO.2SiO_2)$. S. I. T.

OSTYLEVA (E. E.)] Костылева (Е. Е.). Юкспорит из Хибинских Тундр.—KOSTYLEVA (E.). *L'uxporite des Monts Chibines.* Докл. Акад. Наук СССР (Compt. Rend. Acad. Sci. URSS), 1932, pp. 71–78.

A new analysis (average of two) of yuksporite [M.A. **2**–264, **3**–111] given: SiO_2 39·14, TiO_2 15·39, $Al_2O_3 + Fe_2O_3$ 0·60, MnO 0·11, MgO

0·21, CaO 19·04, SrO 3·19, BaO 2·04, Na_2O 7·60, K_2O 7·33, H_2O 1·7 F 3·22, Cl 0·75, total '100·70'. Sp. gr. 3·06. Assuming that and Cl are replacing O, the theoretical formula is $2R_2O.4RO.7SiC 2TiO_2.H_2O$. The nearest mineral to yuksporite is rosenbuschi (Brögger, 1890). In the Khibina tundra yuksporite is found in clo association with pectolite, aegirine, sphene, rinkolite, astrophyllit fluorite, and felspar, in veinlets in the biotite-nepheline-syenite.

S. I. T.

[Kurbatov (S. M.)] Курбатов (С. М.). Пирофиллит из Чистог ровского месторождения на Южном Урале.—Kurbatov (S.). *pyrophyllite du gisement de Tchistaya-gora dans l'Oural du su* Докл. Акад. Наук СССР (Compt. Rend. Acad. Sci. URSS), 193 pp. 131–136.

Pyrophyllite was discovered in a compact light-grey schist work as a talc deposit. The microscopical examination of the rock show a complete absence of talc, but abundant pyrophyllite, with sor quartz, sericite, and carbonates. The optical properties of pyr phyllite are: 2V about 60°, extinction straight, optical sign negativ α 1·59, $\gamma - \beta$ 0·011 – 0·012, $\gamma - \alpha$ 0·046 – 0·048. The analysis of t schist by T. E. Krasenskaya, SiO_2 73·74, TiO_2 0·71, Al_2O_3 21·4 Fe_2O_3 0·07, CaO 0·28, MgO 0·05, K_2O 0·20, ign. loss 4·08, tot '100·31', gives the following mineral composition: pyrophyllite 73·5 quartz 23·90, sericite 1·68, carbonates of Ca and Mg 0·62.

S. I. T.

[Fersman (A. E.)] Ферсман (А. Е.). Периодический закон количест элементов.—Fersman (A.). *La loi périodique de la quantité a éléments*. Докл. Акад. Наук СССР (Compt. Rend. Acad. S URSS), 1932, pp. 261–266.

A new term 'clarke' (in honour of F. W. Clarke) is introduce It denotes the average quantity (number of atoms or total weight) a given element in any geochemical system (geospheres, meteorit sun, &c.). Plotted on a logarithmic scale against the atomic numbe of elements, the clarkes give a characteristic diagram of a giv system. The interpolated average of the clarkes on the diagra shows a curve gradually falling off towards the higher atomic numbe The diagram of clarkes can be interpreted in the light of Boh theory of atomic structure and it has a definite relation to t periodic system and the radioactive desintegration series. S. I. T.

Sanero (E.). *Sulla presenza della prehnite a Monte Loreto in Liguria.* Atti (Rend.) R. Accad. Lincei, Cl. Sci. fis. mat. nat. Roma, 1935, ser. 6, vol. 22, pp. 170–172.

Small, radially fibrous globules of a pale greyish-green colour occurring with quartz on diabase are proved by the following analysis to be prehnite: SiO_2 43·50, Al_2O_3 24·45, CaO 27·05, H_2O 5·19, Fe_2O_3,MnO,MgO traces = 100·19; sp. gr. 2·860. L. J. S.

Sanero (Edoardo). *Sopra due granati delle miniere di Cogne in Val D'Aosta.* Periodico Min. Roma, 1935, vol. 6, pp. 213–220.

Grossular (d^{20} 3·599, n_D 1·747) occurs as reddish-yellow crystals (*d n*) in garnetiferous crystalline limestone overlying the magnetite deposit at Liconi; analysis I corresponds with 78·67% of the grossular molecule. Topazolite (d^{20} 3·826, n_D 1·887) as honey-yellow crystals (*d n*) encrusts diallage-serpentine at Larcinaz; analysis II corresponds with 96·01 % of the andradite molecule.

	SiO_2.	TiO_2.	Al_2O_3.	Cr_2O_3.	Fe_2O_3.	FeO.	MnO.	MgO.	CaO.	Total.
I.	38·96	0·71	19·93	nil	3·43	3·25	0·03	1·31	32·52	100·14
II.	35·40	0·64	0·82	nil	29·76	0·59	0·02	0·82	32·32	100·37

L. J. S.

Rondolino (Rinaldo). *Epidoto di Acceglio (valle Maira).* Periodico Min. Roma, 1935, vol. 6, pp. 153–167, 2 figs.

Dark green crystals of epidote from crevices in gabbro show 24 crystal-forms, including new (380), (10.11.0), (10.9.0) [$a:b:c$ = 1·5807 : 1 : 1·8057, $\beta = 64°\,36'$]. Sp. gr. 3·452, $a:c = -4°$, α 1·7260, β 1·7555, γ 1·7729, $2V_\alpha$ 73° 56′, for another crystal α 1·7366, β 1·7645, γ 1·7795 (Na), $2V_\alpha$ 72° 58′. Analysis gave SiO_2 37·47, Al_2O_3 21·80, Fe_2O_3 15·35, Mn_2O_3 trace, CaO 23·87, H_2O+ 1·11, H_2O- 0·10 = 99·70. L. J. S.

Scherillo (Antonio). *La meionite del Somma-Vesuvio.* Periodico Min. Roma, 1935, vol. 6, pp. 227–239.

Crystals of meionite in geodes in limestone with pyroxene show nine crystal-forms including new *y* (12.4.1) [$a:c = 1:0{\cdot}4393$]. Sp. gr. 2·740, ω 1·5992, ϵ 1·5612(Na); analysis I corresponds with $3CaAl_2Si_2O_8.CaCO_3$ 88, $3NaAlSi_3O_8.Na_2SO_4$ 5, and $3NaAlSi_3O_8.NaCl$ 7 %. X-ray examination indicates a new orientation, (100) becoming (110), with a unit cell a 12·24, c 7·59 Å. ($c/a = 0{\cdot}6201$) containing two mols. of $3CaAl_2Si_2O_8.CaCO_3$; space-group C_{4h}^5 [cf. M.A. **5**–186]. Scapolite from mariolitic sanidinite with melanite and sphene shows the forms *a m r e z* [Dana's letters] and gave $a:c = 1:0{\cdot}4401$. Sp. gr.

2·675, ω 1·5737, ϵ 1·5488; anal. II corresponds with $3CaAl_2Si_2O$ $CaCO_3$ 56, $3CaAl_2Si_2O_8.CaSO_4$ 6, and $3NaAlSi_3O_8.NaCl$ 38 %.

	SiO_2.	Al_2O_3.	Fe_2O_3.	MgO.	CaO.	Na_2O.	K_2O.	CO_2.	Cl.	SO_3.	H_2
I.	41·38	31·59	trace	0·29	20·72	1·38	0·48	4·35	0·18	0·35	0·2
II.	48·68	27·89	trace	0·30	14·16	4·06	1·42	2·58	1·59	0·44	0·2

L. J. S.

Galliher (E. Wayne). *Glauconite genesis.* Bull. Geol. Soc. Amer 1935, vol. 46, pp. 1351–1366, 2 pls., 1 text-fig.

Dredgings from Monterey Bay, California, contain, near the shor biotite (anal. I) derived from the granite of the Monterey Peninsul At a depth of 5 fathoms it shows signs of alteration (II) and this complete at 50 fathoms, the flakes of brown biotite swelling up in spongy grains of green glauconite (III). There is also a gradu change in the optical characters of the material from n 1·65 a 1·60 in the biotite to n 1·60–1·62 in the glauconite, the latter wi low bifringence and no pleochroism. This alteration is due to t action of sulphur bacteria in the black mud and alkaline sea-wat Analyses II and III also show traces of organic matter.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	Na_2O.	K_2O.	H_2O+.	H_2O-.	P_2
I.	36·25	18·25	6·35	17·09	9·01	0·79	—	8·68	2·70	—	—
II.	55·95	11·56	9·99	2·02	6·77	3·95	0·61	4·12	3·22	1·60	0·1
III.	51·90	1·52	27·98	1·26	4·67	0·89	0·53	4·90	4·05	2·10	0·1

L. J. S.

Lemmon (Dwight M.). *Augelite from Mono County, Californ* Amer. Min., 1935, vol. 20, pp. 664–668, 2 figs.

White, colourless, to yellowish cleavage masses of augelite occ in the andalusite deposit on White Mtn. [M.A. **3**–51, **5**–28 Cleavage m (110) perfect, x ($\bar{1}$01) less perfect; mm 66° 57′, mx 77° 4 Sp. gr. 2·67; α 1·572, β 1·575, γ 1·587, 2V 52°, negative $c : \gamma = 34$ Together with lazulite, pyrophyllite, alunite, &c., the mineral h resulted by a hydrothermal alteration of the andalusite. Augeli has been previously known only from Sweden and Bolivia [Mi Mag. **11**–16, **12**–1, **14**–323]. L. J. S.

Pough (Frederick H.). *The morphology of phenacite from two n occurrences.* Amer. Min., 1935, vol. 20, pp. 863–874.

Crystals of phenakite are described from Klein Spitzkopje, Sout West Africa [Min. Mag. **23**–621], and Morefield mine, Ameli Virginia [M.A. **6**–215], and eight new crystal-forms are noted.

L. J. S.

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Printed in Great Britain by JOHN JOHNSON, at the University Press, Ox